THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXXIII. No. 835.] LONDON, MAY 13, 1879. [31ST YEAR.] Price 6d.

GAS PURIFICATION
BY
OXIDE OF IRON.

COOKE BROS.,
CENTRAL DEPÔTS:
CO. DONEGAL, IRELAND;
LONDON DEPÔT:
BLACKWALL, E.;
OFFICES:
26, 27, & 28, FENCHURCH ST.,
LONDON, E.C.

GENUINE TORBAY PAINT
And SPECIAL GASOMETER PAINT.
SEVERAL PRIZE MEDALS. ESTABLISHED OVER 20 YEARS.
These Paints are now used in over 200 Country Gas-Works, and by all the London Gas Companies, on Gas-holders, Scrubbers, Purifiers, &c. Also used by the Admiralty, War Office, Railway Companies, Founders, &c. They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations; do not crack, blister, or flake off; will cover tar effectually.
The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov.* 2, 1866.
Supplied, mixed ready for use, or in paste, as desired.
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PROPRIETORS: STEVENS & CO.,
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WORKS: BRIXHAM, TORBAY.

THOMAS PROUD,
BROOKFIELD GAS APPARATUS WORKS,
103, ICKNIELD STREET EAST, BIRMINGHAM.
CONTRACTOR FOR
LAYING MAINS
FOR
Gas, Water, & Sanitary Purposes,
AND MANUFACTURER OF
WOOD GRIDS
FOR
SCRUBBERS AND PURIFIERS.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, BLAYDON-ON-TYNE,
Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they were also awarded at the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
JOS. COWEN & CO. are the only Manufacturers of FIRE-BRICKS and CLAY RETORTS at BLAYDON BURN.

JOHN RUSSELL & CO.,
LIMITED,
Established at the commencement of Gas Lighting,
MANUFACTURERS OF
TUBES AND FITTINGS.
THREE PRIZE MEDALS,
Paris, 1878.
HEAD LONDON OFFICE:
145, QUEEN VICTORIA STREET.
ALMA TUBE-WORKS, WALSALL;
OLD PATENT TUBE-WORKS, WEDNESBURY.

JOHN BENT & SON,
BELL BARN ROAD, BIRMINGHAM,
MANUFACTURERS OF
WET AND DRY GAS-METERS,
LICENSEES AND MANUFACTURERS OF
HUNT'S
PATENT COMPENSATING METERS,
STREET-LAMPS, &c., &c.
ESTABLISHED 1830.

THOMAS PIGGOTT & CO.,
SPRING HILL, BIRMINGHAM,
MANUFACTURERS OF
TELESCOPIC & SINGLE GASHOLDERS,
CAST & WROUGHT IRON TANKS FOR DITTO,
And Gas Apparatus of every Description.
Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
SUGAR, SALTPETRE, AND ALL KINDS OF PANS.
Roofs, Girders, and Bridges, and General Smith's Work.
London Offices: 97, CANNON STREET—
JAMES E. & SAMUEL SPENCER, Agents.

THE
"OTTO" GAS-ENGINE.
See Page 706.

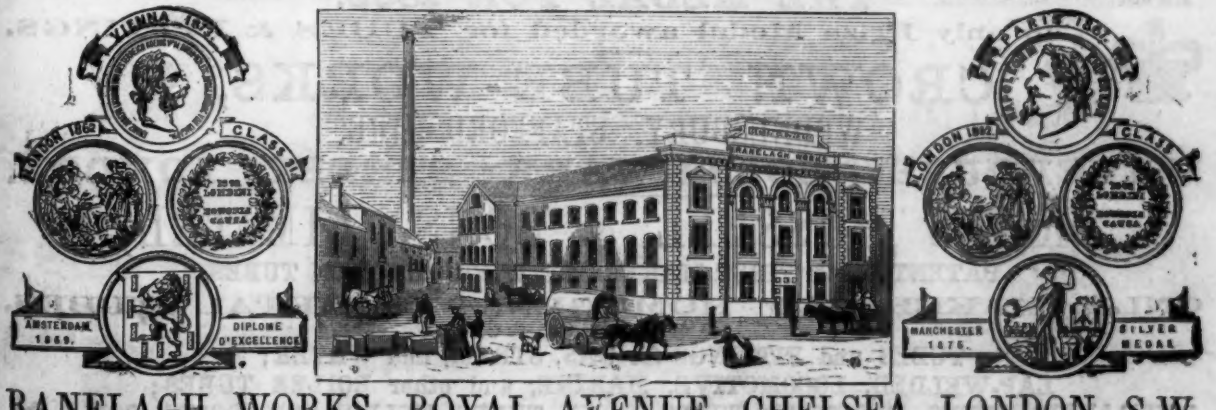
CROSSLEY BROTHERS,
MANCHESTER AND LONDON.

THE
NITSHILL COMPANY'S
DUKE OF HAMILTON'S
LESMAHAGOW
CANNEL COAL.
AGENT:
JAMES M'KELVIE,
HAYMARKET,
EDINBURGH.

CHANGE OF ADDRESS.

GEORGE GLOVER AND CO.,

DRY GAS-METER MANUFACTURERS,
HAVE REMOVED TO MORE EXTENSIVE PREMISES:



RANELAGH WORKS, ROYAL AVENUE, CHELSEA, LONDON, S.W.

SILVER MEDAL, PARIS EXHIBITION, 1867.

LLOYD AND LLOYD,

ALBION TUBE-WORKS, BIRMINGHAM,

AND

COOMBS WOOD TUBE-WORKS, HALESOWEN,

MANUFACTURERS OF

WROUGHT-IRON TUBES AND FITTINGS,

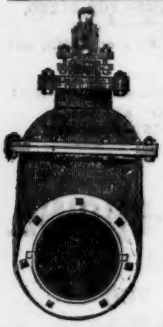
AND

LAP-WELDED IRON AND HOMOGENEOUS METAL BOILER TUBES,

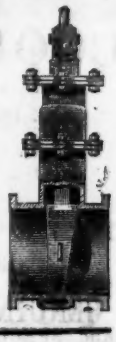
UP TO FOUR FEET IN DIAMETER.

London Offices: No. 4, Cloak Lane, Queen Street, E.C.

Warehouses: London, Liverpool, Manchester, and Lille.



C. & W. WALKERS' DOUBLE-FACED GAS-VALVES.



These solidly constructed double-faced Gas-Valves have taken the place of the old system of the light, single-faced disc, which is too uncertain and unreliable in large bores.

They are guaranteed absolutely gas-tight. They are very massive and rigid, and by improved modes of manufacture they are produced at very little excess in cost over the old light, weak system, which is liable to spring and bend, and become leaky.

The Valve is a rigid wedge of solid cast iron, having two perfectly scraped surfaced facings fitting between the two on the body, which are also surfaced.

A spring in two short halves, and, therefore, not liable to break, is used only for scraping the front facing clean.

The front facing is vertical; the back facing forms the wedge.

At a slight additional expense both flanges are faced to bolt to main-pipes.

MIDLAND IRON-WORKS,

DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

EDWARD E. CROMBIE & CO.,

INVENTORS AND PATENTEES

OF THE

FRICTIONLESS DRY GAS-METERS,

Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

METROPOLITAN WORKS, DIANA PLACE, EUSTON ROAD, LONDON, N.W.

ROBT. DEMPSTER & SONS,

GAS ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,

ROSE MOUNT IRON-WORKS, ELLAND, YORKSHIRE.

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS;

CONTRACTORS FOR THE

ERECTION OF PUBLIC AND PRIVATE GAS-WORKS.

Plans and Specifications Prepared, and Illustrated Catalogues forwarded on application.

TRADE MARK

THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

CROWN TUBE-WORKS,

WEDNESBURY, STAFFORDSHIRE.

WAREHOUSE: SOUTHWARK STREET, LONDON.

JAMES RUSSELL & SONS, LIMITED,

PATENTEES & FIRST MAKERS OF WROUGHT-IRON TUBES,

ONLY MAKERS OF HOMOGENEOUS METAL TUBES.

MANUFACTURERS OF

TUBES and FITTINGS for GAS, STEAM, and WATER;

LAP-WELDED, LOCOMOTIVE, MARINE, and other BOILER TUBES;

HYDRAULIC TUBES, BEDSTEAD TUBES, WELL TUBES, TELEGRAPH POSTS, COILS, &c.

GAS-FITTERS TOOLS, VALVES, COCKS, &c.

THOMAS PIGGOTT & CO.,

(Established 1822,)

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MANUFACTURERS OF

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

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GAS COAL. GAS COAL. GAS COAL.

WELLS, BIRCH, RYDE, and CO., Limited,

HOYLAND SILKSTONE COLLIERIES,

Near BARNSLEY.

This Company is now in a position to raise 2000 tons per day of REAL OLD SILKSTONE GAS COAL.

"The quality of this Coal for Gas purposes, if equalled, is not excelled by any on record, and the Coke competes successfully with best Durham."—See *Mining Journal*, Aug. 11, 1877.

Prices quoted to any Railway Station, or F.O.B. Hull, Grimsby, Goole, Keadby, Liverpool, and Fleetwood.

Full particulars will be sent on application to above address.

HONOURABLE MENTION. **J. E. WILLIAMS & CO.,** PARIS EXHIBITION, 1878.

SOLE MANUFACTURERS OF THE

SPECIAL METALLIC OXIDE PAINT,

Largely used by Gas Companies, Corporations, Railway Companies, Ironfounders, and Machinists. It has the following qualifications and properties:—

EFFECTUALLY PREVENTS AND ARRESTS CORROSION.
HAS A FINE GLOSS. AND IS VERY DURABLE.
DOES NOT REQUIRE DRIERS LIKE OTHER PAINTS.
PROTECTS IRON FROM ACTION OF WATER.

IS NOT AFFECTED BY SULPHURETTED HYDROGEN.
FORMS A VERY HARD TOUGH (NOT BRITTLE) SURFACE.
WILL NOT CRACK, BLISTER, OR SCALE
IS NOT AFFECTED BY EXTREMES OF TEMPERATURE.

COVERS NEARLY DOUBLE THE AREA OF OTHER PAINTS.
(7 gallons or 1 cwt. will cover 1211 square yards of Ironwork.)
IS CHEAPER AND MORE ECONOMICAL THAN ANY OTHER.

VICTORIA PAINT WORKS, COLLYHURST, MANCHESTER.

HYDRATED PURIFYING MATERIAL.

Samples on application.

MESSRS. SPENCE BROS., LIMITED,

Will be glad to supply the above on the most favourable terms, and to treat, by Purchase or Exchange, for Spent Oxide.

PRICES ON APPLICATION.

ALSO PATENT DRY COPPERAS FOR EXTRACTING AMMONIA.

VICTORIA CHEMICAL WORKS, BRADFORD, NEAR MANCHESTER.

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER AND BOILER WORKS

WEST BROMWICH, NEAR BIRMINGHAM (Established 1765),

MANUFACTURER OF

TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST-IRON TANKS FOR DITTO.

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, AND ALL KINDS OF GAS APPARATUS.

WROUGHT-IRON ROOFS, BRIDGES, GIRDERS, ETC

STEAM, HOT WATER, AND RANGE BOILERS, TANKS, CISTERNS, BOATS,

AND ALL KINDS OF WROUGHT-IRON WORK.

Drawings, Specifications, and Estimates supplied on application.

GAS PURIFICATION

BY

OXIDE OF IRON.

GAS PURIFICATION & CHEMICAL Co., LIMITED,

PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.

JOHN WM. O'NEILL, Managing Director.

SAMUEL CUTLER & SONS,

CONTRACTORS FOR GAS & WATER WORKS, GENERAL ENGINEERS, IRONFOUNDERS & MANUFACTURERS OF

GASHOLDERS, TANKS, PURIFIERS,

SCRUBBERS, VALVES, EXHAUSTERS, IRON ROOFS, BRIDGES, BOILERS, AND GENERAL CAST AND WROUGHT IRON WORKS.

S. C. & SONS undertake the entire erection of New, or Remodelling of existing Gas-Works in any part of the World, including small Works for MANSIONS, FACTORIES, &c., or Works of the largest extent (are now constructing the largest Gasholder yet erected); also the supplying and laying of MAINS.

They make a speciality of supplying every requisite whatever for Gas-Works, keeping in Stock what are most in request. WOOD SIEVES for Purifiers and Scrubbers, of a superior make.

SPECIAL CASTINGS to Drawing or Pattern at Shortest Notice.

Manufacturers of MORRIS & CUTLER'S PATENT CONDENSER & CUTLER'S PATENT GAS-WASHER.

DESCRIPTION OF MORRIS & CUTLER'S PATENT CONDENSER.—The Condenser may consist of pipes arranged in tiers, or in any other form most convenient to the site available, each tier being connected with special connections, and containing within same either one or more coils of smaller pipe through which water is passed, being supplied from any convenient source of supply, the water passing in an opposite direction to the gas, so that the coldest water is at the gas outlet. The power of the Condenser can be regulated precisely in proportion to the quantity of water allowed to pass through, which is not in any way contaminated, but simply heated by the hot gas, and advantage can be taken of its being at a high level to carry it to a high-level cistern, from whence it can be used for supply to boiler or any other purpose. The Condenser itself may form the support for a high-level cistern. By an arrangement of valves the water may be shut off, and an air orifice opened, when air will pass through instead of water, or both air and water can be shut off. The power of the Condenser is, therefore, entirely under control. The Condenser may be seen in operation at the Brentford Gas-Works.

For further Particulars, apply to Mr. F. MORRIS, GAS-WORKS, BRENTFORD, or to S. CUTLER & SONS, PROVIDENCE WORKS, MILLWALL (Near the Steamboat Pier), LONDON, E.

1862.

HALLETT'S

PATENT ANTIMONY PAINT.

MADE ONLY BY

GEORGE HALLETT & CO.,

296, ROTHERHITHE, LONDON, S.E.

CLASS II.

Price 30s. per Cwt. Special Driers supplied at same Price.

This light stone-coloured Paint, for which a Prize Medal was obtained in 1862, is free from certain defects of white lead. It does not produce any deleterious effect upon the health of those who use it, such as painter's colic, nor is it blackened by sulphur compounds in the atmosphere; while, from its less specific gravity and good body, it covers more surface, weight for weight, and, therefore, it is preferable and more economical than white lead.

It is peculiarly adapted for Gas-Works.

GOLDSMITH'S PATENT SIGHT WATER-LINE INDICATING GAS-METER.

MANUFACTURED BY GUEST AND CHRIMES,

FOUNDRY AND GENERAL BRASS WORKS, ROTHERHAM; AND 85, SOUTHWARK ST., LONDON, S.E.

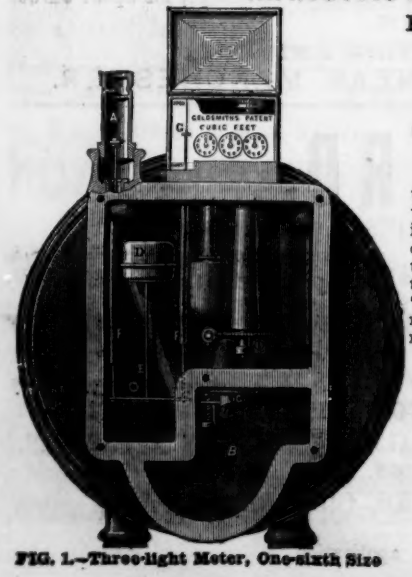


FIG. 1.—Three-light Meter, One-sixth Size

Fig. 1 is a Meter with front removed to show the arrangement and connection of the Indicator and Valve.

Fig. 2 is front view of Index, with cover up.

The principal object of this invention is to render the water-line in the reservoir at all times visible. It will be seen, by reference to the illustrations, that this is accomplished in the following manner:—On the dial are the words "Open" and "Shut," and attached to the float is the pointer G, which rises and falls with the water-line in the reservoir. If the pointer is at "Open," it shows that the valve is open, and that the reservoir is full. If it is at "Shut," it shows that the reservoir is empty, and that the gas will be shut off.

The following ADVANTAGES will be obvious:—

1. The Inspector can see at a glance if the Meter requires water.
2. No more water than is required need be added, and therefore no water has to run out.
3. The Meter Inspector will be spared a great deal of his most objectionable work, and he will save a great deal of time and trouble.
4. The consumer will not always have to be asked for water, nor will he have to endure the unpleasant smell caused by waste water being run out.

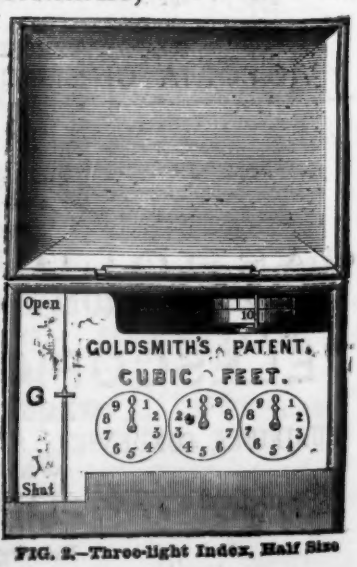


FIG. 2.—Three-light Index, Half Size

GEORGE ORME & CO.,

ATLAS METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET AND DRY GAS-METERS,

STATION-METERS, GOVERNORS,

PRESSURE AND EXHAUST REGISTERS,

LAMP-METERS IN CAST-IRON BOXES,

And every Description of Gas Apparatus.

JAMES MILNE & SON,

GAS ENGINEERS,

Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,

EDINBURGH, AND

2, KING EDWARD STREET,

NEWGATE STREET, LONDON.

Meter Works in London—2, CROSS STREET, WILDERNESS ROW, E.C.

STATION-METERS GOVERNORS, CONSUMERS METERS, GAS LUSTRES, CHANDELIERS, BRACKETS, &c.,

And every description of Gas-Fittings and Gas Apparatus.

J. & J. BRADDOCK,

GAS ENGINEERS,

GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET & DRY CONSUMERS GAS-METERS,

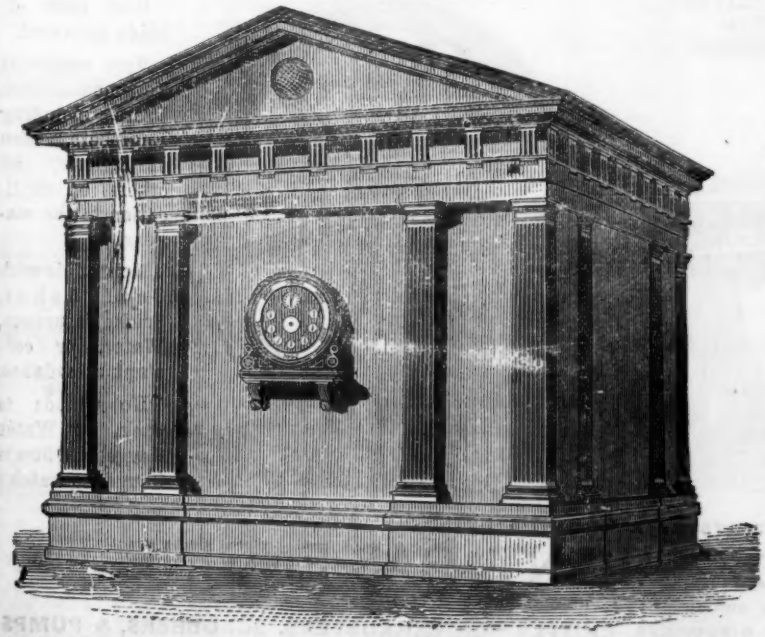
OF THE HIGHEST EXCELLENCE ONLY;

ALSO LICENSEES AND MANUFACTURERS OF

WARNER & COWAN'S PATENT SELF-REGULATING GAS-METERS;

ROUND STATION-METERS,

ON CAST-IRON STANDS.



SQUARE STATION-METERS,

WITH PLANED JOINTS.

GOVERNORS, GAUGES, INDICATORS, MAIN COCKS, &c.

GAS COOKING APPARATUS.

Home and Foreign Orders promptly attended to.

All Sizes of CONSUMERS METERS, STATION-METERS, and GOVERNORS generally in Stock.

Orders almost invariably despatched on the day of receipt.

TERMS, &c. ON APPLICATION.

C. & W. WALKER'S

WOOD PURIFIER SIEVES,

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

MIDLAND IRON-WORKS,
DONNINGTON, NEAR NEWPORT, SHROPSHIRE.
FINSBURY CIRCUS, LONDON.

ESTABLISHED IN 1860.

BENJAMIN CARPENTER,

THE ORIGINAL MANUFACTURER OF THE IMPROVED

WOOD SIEVES

FOR

GAS PURIFIERS & SCRUBBERS.

PROVIDENCE WORKS,
22, HERMES STREET, PENTONVILLE ROAD,
LONDON, N.

MOBBERLEY & PERRY,

FIRE CLAY and BRICK WORKS,

STOURBRIDGE.

Proprietors of
BEST GLASS-HOUSE POT and CRUCIBLE CLAY.
Manufacturers for Home and Export.
GAS-RETORTS, GLASS-HOUSE FURNACE,
BLAST-FURNACE, TANK BRICKS, LUMPS, TILES,
And Every Description of Best Fire-Bricks.

JOHN ROMANS, C.E., F.G.S.E.,

CONSULTING GAS ENGINEER

AND

CANNEL COAL FACTOR,

30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.

GAS-WORKS TAKEN ON LEASE.

Mr. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTER-MIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

GRIRDROD'S PATENT

PORTABLE PIPE SCREWING MACHINE,

For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

W. H. BAILEY & CO.,

Brassfounders, Gauge Injector and Tool Makers,

ALBION WORKS, SALFORD,

LANCASHIRE.

Gold Medal Awarded, Paris Exhibition, 1878.

THOMAS TURTON AND SONS,

SHEAF AND SPRING WORKS,

SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY FOR ENGINEERS,

STEEL OF ALL DESCRIPTIONS,

SCREW STOCKS, TAPS, AND DIES, SPANNER RATCHET BRACES, LIFTING-JACKS, ANVILS, VICES,

AND ENGINEERS TOOLS GENERALLY.

LONDON OFFICE:

90, CANNON STREET, E.C.

R. W. WINFIELD AND CO.,

CAMBRIDGE STREET WORKS AND ROLLING MILLS,

BIRMINGHAM.

The following Medals have been awarded:—

GRAND COUNCIL MEDAL, LONDON, 1851. MEDAL, LONDON, 1862. GOLD MEDAL, PARIS, 1867,

The only Gold Medal awarded for "Apparatus and Processes for Heating and Lighting" by the Imperial Commissioners

MEDAL FOR PROGRESS, VIENNA, 1873.

The following Medals were also awarded at Paris, 1878:—

GOLD MEDAL for Chandeliers and Gas-Fittings.

GOLD MEDAL (Rappel) for Metallic Bedsteads and Furniture.

GOLD MEDAL (Rappel) for Art Metal Work. BRONZE MEDAL for Tube Metal and Wire.

MANUFACTURERS OF BRASS AND COPPER SHEETS,

TUBE AND WIRE,

ROLLED METALS, LOCOMOTIVE AND CONDENSER TUBES, CYLINDERS;

Ornamental, Taper, and Cased Tubes; Tin Tubes;

GAS-FITTINGS, CHANDELIERS,

BRACKETS FOR HEATING AND LIGHTING;

METALLIC BEDSTEADS.

Ecclesiastical and Mediæval Metal Workers.

GENERAL BRASSFOUNDERS.

REGISTERED TRADE MARK:
R. W. W. & CO.

LONDON OFFICES & SHOW-ROOMS: 141, FLEET STREET, E.C.

AN ENGINE WHICH WORKS WITHOUT A BOILER OR STEAM

AVERAGE WEEKLY DELIVERY
(INCLUDING CONTINENTAL)
OVER TWENTY ENGINES.

The durability of these Engines is now established by experience, one of them having run night and day at the Hinckley Gas-Works for over Twelve months without any expenditure for repair; this being equal to about 2½ years average work.

Over 1900 already delivered.

Very numerous Testimonials from Users, including Engineers, Men of Science, and others, on application to the makers.

No trouble with Coal, Ashes, Smoke, Insurance, Water, or constant attendance.

No Glands to pack, or Water Gauges and Steam Gauges to watch.

STARTS AT A MOMENT'S NOTICE.

THE "OTTO" SILENT GAS-ENGINE.

(Otto and Crossley's Patents, 1876 and 1877.)

THEY ARE USED FOR ALL KINDS OF PURPOSES, CHIEFLY FOR EXHAUSTERS, SCRUBBERS, & PUMPS.

DELIVERED IN MANCHESTER. SIZES { NOMINAL HORSE POWER ½ 1 2 3½ 6 8 12 16 / MAXIMUM HORSE POWER ¾ 1½ 2½ 4 9 12 18 24 } OFFERED. CASES NOT CHARGED IF RETURNED FREE

PRICES INCLUDE CAST-IRON STAND, TURNED FLY-WHEEL, AND DRIVING PULLEY; WATER-VESSEL, SEVERAL DUPLICATES, AND GAS-FITTINGS (EXCEPTING METER AND PIPES).

WORKS AND HEAD OFFICES: Gt. Marlbro' St., Gloster St.

CROSSLEY BROTHERS, MANCHESTER.

LONDON HOUSE: 116, Queen Victoria St., E.C.

TANGYE BROTHERS AND HOLMAN,

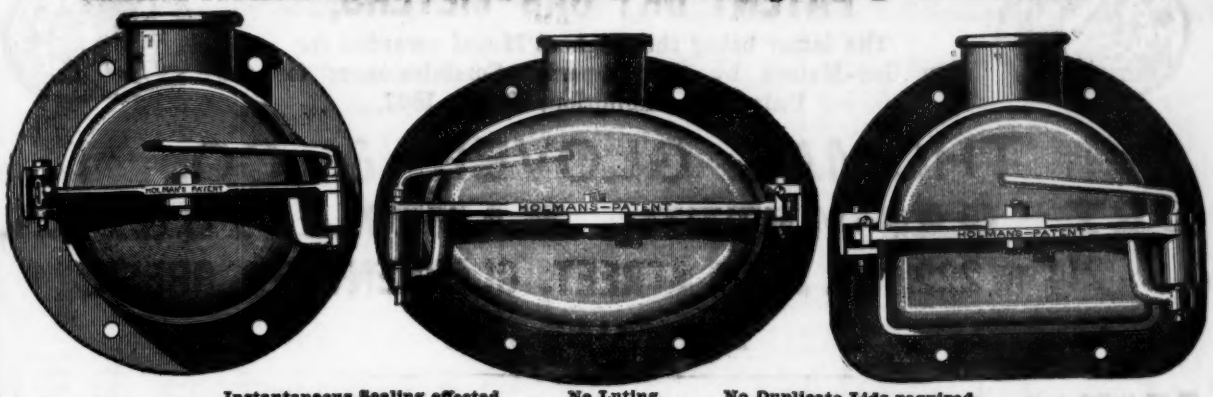
CORNWALL HOUSE, 35, QUEEN VICTORIA STREET, LONDON, E.C.,

(LATE OF 10, LAURENCE POUNTNEY LANE.)

SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.
Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly itested, being now in use in nearly all the principal Gas-Works in London and the Provnces.

T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT (see Illustrations above), as well as bringing the Mouthpiece from the D or Oval at back to Circular in front, as heretofore.

D and Oval Morton's Lids are working satisfactorily both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

The Gaslight Company's Works, Fulham; Ditto, Bromley-by-Bow; Ditto, King's Cross; Ditto, Shoreditch.
And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at an convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

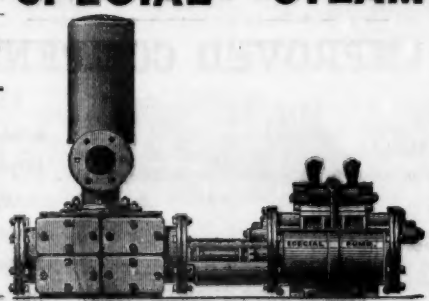
Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,
(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION.

THE "SPECIAL" STEAM-PUMP.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1½	9	450	£16
4	2	9	815	18
5*	2½	12	1,250*	20
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



In use in a Hundred Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have over FORTY "Special" Steam-Pumps in use at their several large Tar-Works.

Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

TANGYE'S HIGH-PRESSURE AND CONDENSING STEAM-ENGINES; CORNISH, VERTICAL, & TUBULAR BOILERS; HYDRAULIC AND SCREW LIFTING-JACKS, CRABS, PULLEY-BLOCKS, &c.

FULL PARTICULARS, ESTIMATES, CATALOGUES, ETC., ON APPLICATION.

London, 1851. New York. 1853. Paris, 1855. London. 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

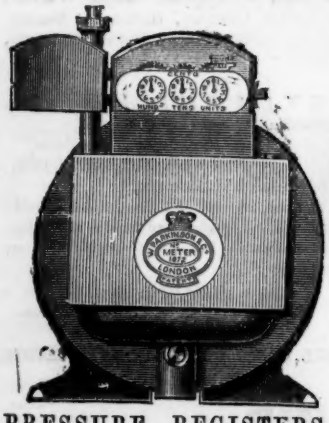
214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS.

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON AND CO.,



(ESTABLISHED 1816,)

MANUFACTURERS OF

WET & DRY METERS,

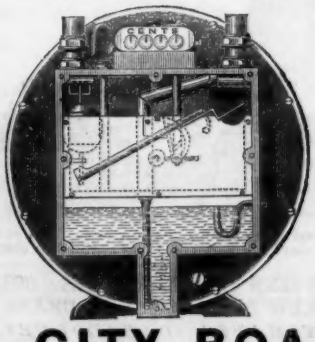
STATION-METERS & GOVERNORS,

EXHAUSTER REGULATORS,

PRESSURE REGISTERS, EXPERIMENTAL APPARATUS, GAUGES, WATER-METERS, &c.

HUNT'S PATENT IMPROVED COMPENSATING METER.

In this Meter, the action of the measuring-drum is reversed. By this arrangement an improvement is effected in the registration at high speeds, which, in many tests, has not varied from the smallest light to three times the capacity of the meter. It works equally well under all pressures. The range of error between the high and low line is much smaller than that allowed by the "Sale of Gas Act."



The Meter has been critically tested, and most favourably reported upon by official Meter Inspectors in London and Birmingham.

W. PARKINSON and CO. have made arrangements for the manufacture of these Meters, both in tin and cast-iron cases, and for the alteration of old ones to this principle, which is confidently recommended as possessing every quality that can be desired by Gas Companies, Corporations, or Private Consumers.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

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TO CORRESPONDENTS.

A. H. W.—*Received. The report will appear next week.*
Dr. Bond.—*Your letter came too late for insertion this week.*

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 13, 1879.

Circular to Gas Companies.

Dr. Lyon Playfair's Select Committee continue their sittings, but it must be admitted that, up to the present time, very little has been shown to indicate the need for legislative interference with the distribution of the electric light. One thing came out prominently, and that was the necessity for keeping the cables conveying the current for the electric light at a respectful distance from the wires carrying telegraphic messages. This is a matter which concerns the Postmaster-General, and it is certain to receive full attention at the hands of the Legislature. The only other thing which turned up, bearing on this matter, was a statement made by one of the French witnesses, of the enormous profits which he alleged had been made by the Société Générale d'Electricité, who, it was stated, had paid large dividends, and had actually redeemed a considerable portion of their capital. This astounding assertion brought out a remark from the Chairman, that a good deal had been heard of the profits made by Gas Companies, but this statement showed that an Electric Lighting Company could realize even more. The evidence given last Friday will appear in our next issue; but we may now remark that, should the statement made by the witness we have referred to be substantiated, the Legislature will be sure to impose some limit to the profits of Electric Light Companies, exactly as they now do to those of Gas Companies. The most practical evidence given last Friday was by Mr. Shoolbred, of Tottenham Court Road, who, while insisting on the effectiveness of the light, as used in the establishment of his firm, candidly admitted that he considered it dear, as compared with gas. But we shall return to this part of the question when we present to our readers the evidence taken last Friday. To-day it is proposed to commence taking the evidence of witnesses who appear on behalf of the Gas Companies.

The Committee of the Gas and Water Companies Association have prepared a petition to the House of Commons, which we print in another column. It sets forth very clearly the objections to legislation in respect to the electric light, in the present state of our knowledge regarding that illuminant. Whatever may occur, it is quite certain that nothing has yet been shown to justify interference. It would have been as well if Gas Companies and others had been granted power to exercise their right of distributing the electric light, but it ought to have been carefully prescribed that it should not be done at the expense of gas profits. The accounts of the two undertakings should have been kept distinct, and the profits apportioned according to the capital respectively engaged upon them.

The Engineer and Chemist to the Metropolitan Board of Works have presented to the Board a report on the results of the experiments with the electric light made on the Victoria Embankment. It appears to be quite conclusive as to the costliness of the new illuminant, and, at the same time, it is admitted that defects are discernible in the light, which science may in time rectify; but which at present are unavoidable. The larger experiment now about to be made by the Metropolitan Board will afford fuller opportunities for deciding on the merits of the light.

There is no getting away from the electric light, and perhaps it is not desirable that we should. The last we have to record about it is a display of apparatus and lights at the Royal Albert Hall, South Kensington, on the evening of Wednesday last, which we are bound to say was most complete. Every kind of instrument now in use for the production of the electric light was exhibited, and there was, besides, the historical collection, which took the visitor back to the day when Faraday first showed the members of the Royal Institution the magneto-electric spark. The apparatuses and their uses were well described by Mr. W. H. Preece, the Electrician to the General Post Office, before an audience which included Royal personages and some of the most eminent scientific men of the day. But it cannot be said that the display of the lights was all that the inventors and their admirers could desire. The fact is that both the advantages and the defects of the electric system were well illustrated. In some cases the lights—or we ought rather to say the apparatuses—obstinately refused to display their effulgence, and Mr. Preece had sometimes occasion to preface the commencement of an experiment with the observation that apparatus which worked well before the lecture, often failed when required at the lecture. This is damaging for the electric light, because what happens at a public lecture may occur in the streets. We have had enough experience of the electric light in our thoroughfares to make us acquainted with the fact that all the electric lights at present in use are liable to sudden extinction. This was sufficiently illustrated at the Albert Hall, where many failures occurred, and great successes were obtained. Although the immediate practical value of the display is not easily ascertainable, much praise is due to the Society of Telegraph Engineers and the Albert Hall Council, for getting up the exhibition, which was pregnant with interest. The visitors may not have been altogether pleased with the effect of the illumination, for, despite the assurances of some admirers of the electric light, ladies dresses and complexions did not show to advantage, and to many the effects produced were painful. We doubt whether the use of the light will be at all advanced by the display; but of that we shall learn more anon.

We are given to understand that no serious opposition will be made to the scheme for the amalgamation of the South Metropolitan and Surrey Consumers Gas Companies, a reprint of which will be found in another column. There are, of course, vestrymen who look with suspicion on everything done by a Gas Company; but in this case there is surely sufficient to indicate the *bona fides* of the South Metropolitan Company. An immediate reduction of sevenpence per thousand feet in the Surrey Company's district is a boon which we should have thought every one would have appreciated at its full value. A more liberal act has never been proposed. The stumbling-block appears to be a misunderstanding in the reading of the second proviso of clause 36 of the schedule, which proposes "that if the price of 3s. 9d. "now charged in the district supplied by the Surrey Company "be reduced to 3s. 2d., and the price of 3s. now charged in "the district supplied by the South Metropolitan Company is

"continued at that or any lower rate, the United Company "may, for a period of twelve months after the commencement "of the amalgamation, pay dividends on the capitals of each "Company respectively, at the rate prescribed by section 21 of "the South Metropolitan Company's Act, 1876," with the reservation that, in accordance with a previous section, the Companies share and share alike up to eleven per cent., after which any excess of profit will go to the South Metropolitan shareholders. This is surely very plain, and need not puzzle any one. The other proviso—that the United Company shall not be liable to penalties for want of due purification at the Surrey Company's works until the expiration of twelve months from the date of amalgamation—is very fair. Although purification is carried on with considerable success at the Surrey works, it will be necessary, in view of the extensions in the carbonizing plant, to enlarge and re-arrange the purifying apparatus, and this will take time to accomplish. These two provisoes, so far as we learn, are the only parts of the scheme to which it is possible that objection may be taken; but still we think that no opposition is likely to be successful.

The first issue of shares under the Chartered Company's Act of 1876, will be put up to auction on the 19th of June. The amount of capital to be issued is £100,000. It will be curious to see what premiums will be realized. We anticipate that notwithstanding all the fuss made about the electric light, very high prices will be offered. These premiums will constitute an important part of the Company's capital, but too much must not be expected of it. A considerable quantity not entitled to dividend must be accumulated before an impression will be made on the price of the Company's gas.

The London Gaslight Company have imitated the Chartered in withdrawing the Bill they were promoting to obtain the same objects as were proposed in the Bill brought forward by the latter. We may say again that we are sorry the opinion of Parliament was not taken on the points raised in the projected measures. It would be easy to make out a very strong case in favour of the supervision of fittings, and we rather think a Committee might have been persuaded to grant the powers asked. The question, however, is sure to be raised again, and we shall probably next year have the decision of a Committee on the matter.

Parliamentary Committees are now in full work, and are rapidly disposing of the Gas Bills. During the past week the Brighton and Hove Company's Bill passed a Lords Committee just as it left the Commons. A Committee of the Lower House passed the preamble of the Mirfield and Ilkley Gas Bills. In the former case, the proposed capital of £50,000 was reduced by the Committee to £27,500, and sixpence was taken off the initial price proposed in the Bill. In the latter case, too, sixpence was taken off the initial price; but the other parts of the Bill passed without objection.

Gas consumers must begin to look sharp about the payment of their accounts. Two Provisional Orders have been granted by the Board of Trade—namely, those applied for by the Cleethorpes and Wellingborough Gas Companies—which contain what is called a "fine clause." This clause gives the Companies power to add five per cent. to the amount of the bill, if it be not paid within a month, and the fine and the amount of the bill can be recovered together. It strikes us that this is a little harsh, especially as nothing is said in the Orders about discounts. For our own parts, we would rather see Gas Companies encouraging the consumers to pay promptly, by offering them liberal discounts, than by imitating the practice of West-end tailors in making additions to the bill when it is not paid.

The Corporation of Lancaster and the Gas Company have come to terms, and the undertaking of the latter will be transferred to the former in consideration of the payment of £87,000, the stock-in-trade to be taken at a valuation. It seems that the Corporation obtained authority to purchase the works by agreement as early as 1856, when the Company were incorporated, so that now there is no necessity for any appeal to the ratepayers, or for any parliamentary sanction to the purchase. The works are reported by Mr. G. W. Stevenson and Mr. James Mansergh to be in excellent condition, and nothing will be required in the way of extension for the next two years. There is no doubt that the Corporation of Lancaster have made a very good bargain, and, under the continued superintendence of the able Engineer of the Company, the undertaking is certain to remain profitable.

Gas exhibitions are all the rage. Another small, but still complete display of cooking, heating, and illuminating apparatus was opened last week, under the auspices of the Maidenhead Gas Company. A good deal of interest seems to have been excited in the town by the exhibition, and especially by the lectures of a lady cook. A novel, but perhaps useful feature was that, in order to demonstrate the capabilities of the cooking apparatus, the Company "took in bakings" as long as the exhibition lasted; that is to say, they cooked dinners gratuitously for any one who chose to take them to the Town Hall. We trust that the Maidenhead Gas Company will find the exhibition turn out to their advantage.

The Limerick Corporation have issued an advertisement, asking for tenders for a loan of £54,000, in bonds of £100, £500, and £1000, bearing interest at four and a half per cent., at a price not less than ninety-eight per cent. It is highly problematical whether or not the Corporation will receive any applications at all. From Limerick investors, we fancy they will get nothing. In these days, when money is really a drug in the market, outsiders who know nothing of the affairs of the Corporation may be disposed to lend them small sums. The story told by the Corporation of the prospects of their gas undertaking is really a flattering one, and, if perfect confidence were established, the money might easily be raised; but, unfortunately, public confidence in the Limerick Corporation has been so much shaken by past revelations, that no one acquainted with their doings is likely to entrust them with money. And yet there is no reason why the undertaking should not be a profitable concern. With honest and careful management, the works must of necessity become a valuable property. Our readers will understand that the £54,000 is required to take over the undertaking of the Limerick Gas Company, lately the United General. The loans are to be paid off by means of a sinking-fund, which is to be commenced in 1882, and in 1884 the Corporation propose beginning to redeem the bonds at par. According to the statement of the Gas Committee of the Corporation, the revenue of the gas undertaking will be much more than sufficient to pay the current interest on the bonds and the contributions to the sinking-fund. Beyond the gas revenues, however, the additional security of the improvement rate is offered to investors. We shall see how the Corporation fare in their venture; but it does look odd that the whole sum could not have been raised at once from some bank or insurance office.

The seventh annual meeting of the West of Scotland Gas Managers Association took place at Coatbridge on the 25th ult., when the President (Mr. S. Stewart, of Greenock), who resigned the chair, delivered his valedictory address. In it he dwelt upon many points of superlative interest to gas managers. He pointed out the various portions of works in which improvements were necessary, mentioning especially the necessity of finding means to keep the retorts at one uniform temperature. With regard to scrubbers, Mr. Stewart advocated the use of a multiplicity of apparatus which we should have thought would have been unnecessary in small works. The evil he deprecated in overwashing gas would, we should think, be aggravated by the use of three scrubbers in comparatively small works. On all other points, we perfectly agree with the remarks made by Mr. Stewart. He concluded his address with an excellent account of the new works of the Coatbridge Gas Company, and this was followed by the reading of a short paper by Mr. A. Scott, of Falkirk, "On the Analysis of Gas Coals." The author has been at the pains to test on a considerable scale the coals reported on by analysts who have distilled only small quantities, and his results do not agree with those obtained by the chemists and gas managers who reported. Mr. Scott should be careful how he falls foul of these gentlemen, for a ready retort is at hand, and we are afraid that the analysts would get the best of the argument. We are pleased to say that the meeting was very largely attended by the members, and an unusual interest was displayed in anticipation of Mr. Stewart's address.

We are happy to say that the Durham coal miners strike is virtually at an end. All the gas coal pits will, we believe, be re-opened this week, and trade will resume its normal state, it being generally supposed that prices will rise. But little inconvenience, we are told, has resulted to Gas Companies in consequence of the strike, which, if it had continued a little longer, must, however, have entailed a serious disarrangement of commerce. Another small strike is threatened in Northumberland, but this will be of little importance to Gas Companies.

At the ripe age of eighty, a gentleman whose name will always hold a prominent place in the history of gas purification, has just passed away. We allude to the death of Mr. Richard Laming, M.R.C.S., which took place at Arundel on the 3rd inst. After all that has been said, we think it must be admitted that Mr. Laming was the first to introduce oxide purification, and to describe the process of revivification. His French patent of Feb. 22, 1849, contains, we believe, the first account of the process of purification by oxide, and the means of revivifying the material. Perhaps he did not fully appreciate the value of his discovery, for he neglected to take out any English patent, which could easily have been obtained in those days, when the patent law was more lax than at present. But Mr. Laming was

an ammonia maker, and his inventive powers were directed rather to the abstraction of ammonia from gas than the removal of sulphuretted hydrogen. His experiments in this direction led him to use a mixture in which oxide of iron was an ingredient, and by them he found that a considerable portion of the sulphuretted hydrogen was removed by the oxide. This, no doubt, led him to prosecute his inquiries further, the result of which was the French patent we have mentioned. It may be justly said that Mr. Laming's discovery revolutionized the art of gas purification. From the date of the introduction of oxide, sulphuretted hydrogen ceased to be a difficulty and a nuisance. Mr. Laming lived long enough to see the use of oxide extended to every considerable gas undertaking in this country and abroad, and, although he might have looked with pride on the results of his observations and experiments, he may perhaps have been somewhat disappointed at the small pecuniary compensation they brought him. Many Gas Companies will learn with regret the death of an old friend, whose labours were of so much value to them.

Death has been busy with younger men well known in the Metropolitan gas world. We mentioned last week the decease of Mr. Thomas Wills, F.C.S., lately one of the Gas Examiners of the Metropolitan Board, and the Examiner and Chemical Adviser to the Phœnix Company. The death of this gentleman constitutes a serious loss. He was indefatigable in his devotion to gas chemistry, and much might have been expected of his labours. His latest work, we believe, was an examination of the gaseous products of the electric light, among which he necessarily found nitric acid. The production of this body was, of course, to be inferred from what happens in a thunderstorm. Every flash of lightning which darts through the air causes some combination of the ingredients of the atmosphere, resulting in the production of nitric acid, which, rinsed down by the rainfall, finds its way through the soil, and, we may remark *en passant*, used to turn up again as "previous sewage contamination" of water. Mr. Wills showed that the electric arc brings about the same combination, and although the acid product may be small, it is worthy of being taken into consideration. Apart from the promise of his scientific labours, numerous friends regret the loss of an estimable man whose amiable disposition endeared him to all who enjoyed his acquaintance.

We very much regret to have to add to our list the death of Mr. W. G. Valentin, F.C.S., which took place suddenly, at Hastings, on the 1st inst. The deceased gentleman was for many years Gas Examiner and Chemical Adviser to the old Western Company. He was at the time of his death, and had been for many years, Chief Assistant at the Royal College of Chemistry. As all the laboratory instruction at this Institution devolves on the Chief Assistant, Mr. Valentin's duties were very onerous; but he discharged them with much success. His work on elementary chemistry has made him widely known, and the chemical world will much regret his loss.

Water and Sanitary Notes.

The Vestry Delegates had, on Friday last, an interview with the Home Secretary, with the idea of persuading the Government to take up the Metropolitan Water Question. It is worthy of remark here that the principal complaint brought against the Companies urged that a rate for water, fixed on annual value, was extremely unjust. Without disputing the point, we may observe that no member of the deputation suggested any other mode of rating. There is, of course, the meter system, but that is altogether inapplicable to ordinary domestic service. The quality of the water supplied was scarcely impugned; and as to quantity, it was admitted that the supply was amply sufficient. The one great want insisted upon was, unity of management amongst the Companies, which would ensure economy, and allow of a supply on the constant system, at a much cheaper rate than at present obtains. Failing a union among the Companies, which we have always strongly advocated, and purchase by the present Authorities, which we have always deprecated, the deputation expressed themselves desirous, pending the formation of a Municipality for London, to see the water undertakings handed over to some special Commission. Mr. Cross, in his reply, pointed out that the Companies were only acting under the powers conferred upon them by Parliament, and that they could not be interfered with except by legislative measures. There was this further said—and Mr. Cross put it plainly—that any alterations proposed could only be effected with the consent of the Companies. Here, we may take it, the water agitation ends for the present year. Without stating so explicitly, Mr. Cross obviously intended to convey to the deputation that the Government will not interfere in the matter. Mr. Cross complained that the deputation had brought with them no figures to show what it would cost to buy up the Companies, or any scheme for their management supposing they were taken over by some innominate body. He was answered that a scheme had been prepared, and would be produced at the proper time, which was a rather odd way of dealing with the Secretary of State when a deputation went to him with a special request. Now, there is really very little difficulty in the assessment of the marketable value of the Metropolitan Water Companies. The expended capital of the collective Companies at the present time is £11,911,406, the average dividends on which are, we may take it, seven per cent. Now, twenty-five years purchase of these dividends would represent a capital sum of about £32,754,356, to which must be added a bonus of ten per cent. for compulsory purchase. This sum, or something like it, is what will have to be paid if purchase be effected. But there is another way of obtaining the undertakings, always supposing we had a Municipal Authority competent to take them over. The maximum parliamentary dividends might be guaranteed, and the capital made redeemable by means of a sinking-fund within a limited number of years. But it is unnecessary to speculate. All dreams of a transference of the undertakings of the Metropolitan Water Companies to any Authority may be dispelled. Any change, as far as can be seen at present, must be initiated by the Companies themselves, and they collectively can, by their own "mere motion and special "grace," do everything which the Metropolitan public are now so anxious to see accomplished.

Now, then, is the time for the Companies to act for themselves. If they will only dispassionately consider the matter, and put aside petty jealousies, they will see at once how much good may be effected by union. Economy in management is, we may say, the smallest advantage we look to as the result. It is to that general combination of works, which we feel satisfied would allow of greater attention being paid to filtration and other means of purification, and at the same time accelerate the introduction of the constant supply system, which is so much desired. We press the desirability of amalgamation once more upon the attention of the Companies, earnestly hoping that before another session of Parliament arrives some step will be taken to bring about that much-to-be-desired result.

We are happy to be able to state that the Corporation of Manchester have carried their Thirlmere Water Scheme. On Friday last it passed a Committee of the House of Lords with scarcely a show of opposition. With that promptitude which Manchester always exhibits, we have no doubt that the works will very soon be commenced; and although it will be several years before the waters of Thirlmere are distributed in the city of Manchester and neighbourhood, there is a certainty that before long an ample provision will be made, which will last perhaps as long as Manchester exists.

The Water Committee of the Liverpool Corporation still hesitate to decide on a source for their additional supply. The Vyrnwy scheme seems to be favoured; but the discussion of the matter has been deferred, and perhaps in the meantime it may be discovered that some other plans promise greater advantages. Now that Manchester has her Thirlmere scheme, it may be worth while for Liverpool to take into serious consideration whether it would be advisable to share in their supply.

The Nottingham Corporation and the Water Company have at last arranged terms for the transfer of the undertaking, and on the 30th of March next the water supply will be in the hands of the Corporation. Disliking, as we do, all transfers of the kind, we feel bound to admit that in this case very liberal arrangements have been come to. The capital of the Company, as we have said before, is, in round numbers, £350,000, the dividend on which was limited to five per cent. It has now been settled that the Corporation shall take over the works, paying annuities to the Shareholders at the rate of seven per cent., with a bonus of £20,000. The last bone of contention was the demand of the Company for a further sum of £10,000, representing a cash balance estimated to have accrued at the time of the transfer. The seven per cent. on the paid-up capital of the Company, at twenty-five years purchase, represents a sum of £612,500, which may be considered a fair price for the undertaking. Some silly talk took place about starting a rival supply, if the Company did not accept the terms of the Corporation; but it was generally recognized that an additional water supply was unattainable, and hence the consent of the Corporation to the terms firmly insisted upon by the Company. Nottingham will be neither the better nor the worse for the change of proprietorship. Water will not be more plentiful nor cheaper to the consumer. Some little profit may by-and-by be made by the Corporation, the application of which will very little aid the rates, and that is all the result that can be expected.

THE PRESENT PHASE OF THE ELECTRIC LIGHT.

THE electric light has been holding high carnival in the Albert Hall. The scene on Wednesday evening was a grand one, and perhaps we should be rather at a loss to cite a period in the history of artificial lighting when gas was similarly favoured with an exhibition enjoying the presence and patronage of royalty. Gas arose in a dark age. There was no Albert Hall in those days. Sir Henry Cole was born, but he was not famous, and the new light had some powerful foes, even among men of science. The electric light is a favoured child, and will not suffer from lack of friends. Gas has fought its way up by sheer merit, and is even well abused at the present hour. We allow that the proceedings at the Albert Hall, when the Prince of Wales presided over an assembly of thousands, and the Electrician of the Post-Office gave his highly experimental lecture, were replete with interest. A shower of shooting stars could scarcely have been more brilliant than the flashing lights which sprang up right and left at the bidding of Mr. Preece. There were lights coming and going everywhere, from the floor to the ceiling, until the audience must have been bewildered to know where the light—arc, incandescent, or candle—might possibly spring from next. When Mr. Edison hears the full story of the gala night at South Kensington, he must mourn that he was not ready to take part in such a demonstration, though he may console himself with the thought that, like Nelson with his *Gazette*, so he shall have the Hall to himself alone on a future night.

Leaving the Royal Albert Hall and proceeding to Spring Gardens, we enter the sober precincts of the Metropolitan Board of Works, though, when we think of Mr. Leslie and his performances, the idea of official propriety is somewhat dissipated. Prior to an extraordinary *dénouement* on Friday last, when Sir James Hogg vacated the chair, and the members followed, leaving Mr. Leslie to "re-assert" himself to the empty benches, there was laid before the Board a document, which told in calm and perspicuous terms the story of the electric light, as exemplified by the trial of the Jablochkoff system on the Victoria Embankment. This report bears the conjoint signatures of Sir Joseph Bazalgette and Mr. Keates; but it is obvious, from the nature of the facts involved, that the burden fell mainly on the latter, who, as the Consulting Chemist to the Board, had the conduct of the investigation, and directed the various experiments. The report is of considerable length, and is admirably clear and comprehensive, containing both data and deductions, which will be of value to all who are interested in the problem of electric lighting. The Société Générale d'Electricité are unquestionably indebted to the Metropolitan Board for a report which will serve as a most important guide to the officers of that Company, affording them information which cannot fail to assist them materially in their future operations. We may now be said to learn with absolute certainty what is the photometric value of the Jablochkoff candle, and we also learn some important facts as to its cost. The scientific observations of Mr. Keates will command universal confidence, the experiments being conducted with the highest skill and the most exemplary care, under circumstances which favoured the accomplishment of exact results. Everything was thoroughly well arranged, and no complication or breakdown of any kind appears to have intervened.

In the first place, as already intimated, we learn what is the real illuminating power of the Jablochkoff light. Observed horizontally, the naked light is equal to 378 sperm candles. In the absence of photometric observations—an omission much to be regretted at the time—Colonel Haywood estimated the lighting power of the Jablochkoff lamps on the Holborn Viaduct at 1200 candles for each of the lights when uncovered. The City Engineer very properly gave his authority for the statement, and it is now evident that his authority was in error. Colonel Haywood stated in his report: "Each electric lamp is said by "the Société to be equal to one hundred gas-burners such as are "used in the streets of Paris." Reckoning the latter at twelve candles each, the estimate of 1200 candles was the result. With these figures to work upon, Colonel Haywood concluded that with fifty per cent. of the light cut off, the electric light on the Viaduct cost about seven and a half times the price of gas, while in comparison with gas the lighting power was about seven times as great. This put the two nearly upon an equality. But now that the lighting power of the Jablochkoff candle is shown to be less than one-third the estimate employed by the City Engineer, we see that such a correction makes the electric light on the Viaduct three times as costly as gas.

Having for a moment digressed, we revert to the precise results obtained on the Embankment. Experiments with the opal globe singularly confirm the statements previously current, that the light intercepted by such a medium is as much as sixty per cent. Mr. Keates found it to be fifty-nine per cent., thus reducing the 378 candles to 155. But by means of a frosted globe, the loss was limited to thirty per cent., thus making the light equivalent to 265 candles. In the next place, we come to the question of cost. This is reckoned at so much per lamp per hour. Interest on capital, together with wear and tear, create a charge of 0·49 pence, added to which we have the current charge for working the engine, and other matters, amounting to 3·24 pence, the two together making 3·73 pence. To this we have to add the cost of the Jablochkoff candle—that is to say, the carbon device which emits the light. On this point, it appears there is some difficulty. When the trial on the Embankment commenced, the price charged to the Board by the French Society for the carbon candles was sixpence per lamp per hour. On the 1st of February last, this was reduced to fivepence; but now, under the new arrangement, by which additional lights are put on the Embankment, the French Society undertake to maintain the lamps all round at the rate of fivepence per hour per light net. "That "is, inclusive of the cost of working steam-engine, electric "machines, and all other current charges." Accordingly, we are told, this "leaves but a small sum to pay for the candle." It is, however, believed that the engine can be made to sustain forty lights instead of twenty, and it is even suggested that the number can be raised to sixty. The report then states: "If "these ideas prove correct, of course the whole cost of working "will be reduced, and the sum which is being paid—namely, "fivepence per hour, including all charges—may be remunera-"tive." In the face of the reduced price which the French Society are now charging, it is thought useless to reckon the cost of the candle which the Board previously paid—namely, fivepence per hour, and, under all the circumstances of the case, it is considered that "twopence per hour for the candle would be "a very sufficient charge." Adding this, therefore, to the items already mentioned, the total cost of producing the light, per lamp per hour, becomes 5·73 pence.

It would thus appear that in charging fivepence per lamp per hour, under the new agreement, the French Company are losing three-farthings per hour on each lamp. It may, however, be answered, that the increased number of lights, being unaccompanied by any increase in the amount expended for wages, will have a favourable effect on the hourly charge per lamp, so as to render the reduced price remunerative. Such, indeed, is the explanation suggested in the official report. It is an encouraging fact for the managers of the French Company, that the engine of 20-horse power nominal which they considered necessary for sustaining twenty lights, proves sufficient to sustain forty, if not sixty lights. There is no doubt that the engine with which they have been furnished is a remarkably good one, reflecting the highest credit on the firm supplying it—Messrs. Ransome, Sims, and Head, of Ipswich. Mr. J. N. Shoolbred, in his treatise on "Electric Lighting," just published, in the chapter on "Motive "Power" as applied to the driving of the dynamo machines, says: "The one pre-eminent requirement which is exacted from "all motors is that of extreme regularity of movement, not only "during each revolution, but also during successive revolutions." Mr. Shoolbred specifies "a good sensitive governor" as a most important part of the affair, and we find it stated in the report to the Metropolitan Board, that "The principal feature of the "engine is an automatic governor of remarkable sensitiveness;" and figures are given in proof of this assertion.

In order to compare the cost of the electric light with that of gas, recourse is had to some instructive experiments by Mr. Sugg. The result shows that the cost of each electric light being 5·73 pence per hour, the equivalent of gas costs either twopence or threepence halfpenny, according as it has to compete with the electric light in the opal or the frosted globe. For the future, as already explained, the cost of the electric light is to be fivepence per hour, and if we consider this in relation to the frosted globe, the excess of the electric light in price as compared with gas will be three-halfpence, or 43 per cent. But it appears to us that the equivalent hardly settles the question. Two different modes of illumination applied to a given area are not practically equal to each other, unless they are equal in their minima of light. The value of a light, for practical purposes, is to be estimated by the darkest place, just as a beam is only as strong as its weakest part. If the aggregate light of the electric lamp on the Embankment is made actually the same as the aggregate light of the gas-lamps, we shall be safe in saying that the gas will illuminate the Embankment more effectually than the electric light. It is very properly pointed out that the electric lights on the Embankment have been placed at a disadvantage, by being located on the parapet, instead of being brought nearer the roadway. We should say that, to compare fairly with gas, the electric lamps ought to have been placed alternately on each side of the

road, along the kerb. Of course, the more effectual way would be to plant them down the centre of the road; but perhaps a similar privilege might be claimed for the gas. As it is, the full lighting power of the gas-lamps which the electric lamps were considered capable of superseding on the Embankment—the latter being on the parapet—was 1336 candles, while the aggregate light from the opal globes of the electric lamps was equal to 3098 candles, or 2·3 times the amount given by the gas. Of course, the comparison is imperfect, owing to the electric lamps being placed at a disadvantage on the parapet. But the same may be said of a portion of the gas-lamps, where gas is employed. It would be more to the point, for practical purposes, if a street, instead of the one-sided Embankment, were lit up with electric lamps in comparison with gas.

In submitting these considerations with regard to lighting power, we seem at once to raise the question whether it is wise to concentrate a large amount of light in a single gas-lamp. The existing limit may be too low, but in many of the experimental lamps the power is probably too high. As we have just contended, the efficiency of the illumination must be estimated by the minima. On this ground, gas competes at a great advantage with the electric light, and—as we have urged on a former occasion—the position is one not to be sacrificed. The principle is obvious. If all the gas-lamps in Fleet Street were concentrated in one spot, half the street would be in darkness. On the other hand, it is equally true that if all the gaslights in Fleet Street were represented by a distribution of farthing rushlights, the illumination would be unsatisfactory. The problem to be solved is how far to go in one direction or the other, and we are led to conclude that, if the street gas-lamp is at present rather too small, the electric light is wastefully big. Dr. Siemens would have a dazzling beacon-light placed on a post forty-five feet high, and would have a row of such posts, a hundred yards apart, for the purpose of illuminating the Thames Embankment. At the Albert Hall, the five Siemens lights in the ceiling are 150 feet above the floor, and it is stated that the Hall is thus lit at one-third the cost of gas. But the effect is not a pleasing one, and the noise of the lamps is distressing, resembling nothing so much as the hissing and spluttering of a frying-pan in active operation. Such a row overhead during a concert would be unendurable.

The conclusion arrived at by Sir Joseph Bazalgette and Mr. Keates is to the effect that electric lighting has now established itself as a mode of illumination, which, "under particular cir-"cumstances of street lighting, or lighting of great interiors, "railway stations, or similar places, will be used." At the same time, the report states "there are defects connected with "the electric light which must prevent its adoption as a general "mode of lighting competing with gas." "There is," say the two gentlemen whose names give weight to the statement, "in "our opinion, no prospect at present of any such general com-"petition." This appears to be the universal verdict, even among those who are most intimately identified with the subject of electric lighting. The grand and careful experiment on the Thames Embankment, even when improved upon by the most recent and favourable data as to cost, shows that the electric light is necessarily limited to special cases. Gas, on the contrary, is extending and multiplying its uses, and seems, on the whole, rather to have grown in favour than otherwise, since the beginning of the recent excitement with reference to its presumed rival.

Ashton-in-Makerfield Local Board Gas-Works.—At the meeting of the Ashton Local Board last Wednesday, a statement showing the working at the gas-works for the past two years was submitted. The results were—

	Gas made.	Coals used.	Gas made in Feet per Ton.
1877-8	3,903,000 feet	450 tons	8700
1878-9	5,566,000 „	601 „	9700

The following is a statement showing how the gas has been distributed, and also the quantity unaccounted for through leakage:—

	1877-8.	1878-9.
Private consumers	2,953,400	3,943,500
Public lamps	459,600	1,033,200
Used in works	50,000	70,000
In stock	—	47,000
Unaccounted for	440,000	472,300

The length of mains which were in existence at the time the Board took the works was about 4000 yards. The total length at the present time is about 12,070 yards, of which about 8610 yards have been laid during the past year. When the Board purchased the gas-works the number of consumers meters was 140, and the number of these at this date is 299, showing an increase of 159, 54 of which have been laid during the year just ended. In connection with the works the new gasholder has been completed, and has been working satisfactorily during the past six months, scarcely any leakage being now perceptible. The Board were recommended to reduce the price of gas to consumers from 5s. 10d. to 5s. per 1000 feet, and the price of that to Pewfall Colliery from 4s. 10d. to 4s. 2d. per 1000 feet, subject, as before, to a reduction of 10 per cent. if accounts be paid by thirty days from the end of each quarter; the proposed reduction to date from the 1st day of July next.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CLXXIX.

THE TREATMENT OF RESIDUAL PRODUCTS.

Nitronaphthalene (C_{10} H_7 NO_2).

This substance, called by Laurent, nitronaphthalase, is most readily prepared on the large scale by Pirin's process, which consists in treating naphthalene in the cold with nitric acid having a specific gravity of 1·33. The process may be carried out on any scale with the greatest ease. Large shallow earthenware acid-proof pans are to be charged with nitric acid of the specific gravity given above. The naphthalene, in fragments or scales, is to be added. After a time, which varies with the temperature of the atmosphere, the naphthalene will be found to have agglomerated into a cake. As often as this happens, it must be broken up into fragments, and returned to the acid. After five or six days the nitrification will be found to be completed. Five or six parts of nitric acid, of the strength given above, will be found sufficient for one of naphthalene. As no red vapours are evolved, the process may be carried out on any scale without distress to the workmen, and, in this respect, offers a great contrast to the preparation of nitro and dinitro benzene. The process having been completed, the product is to be thoroughly drained on stoneware funnels. It is then to be crushed and washed with cold water until the latter comes away free from acid. It may then be crystallized from boiling methylated spirit. The writer has prepared large quantities of nitronaphthalene by this method, even in the laboratory, without the annoyances which, more or less, attend the preparation of most nitro-compounds.

According to A. d'Aguiar ("Deut. Chem. Ges.," Ber., V. 370) at least seven distinct nitro-compounds are producible by the action of nitric acid on naphthalene, under different circumstances of strength, temperature, &c. He prepares mononitronaphthalene (the same substance as that described above) by dissolving naphthalene in boiling glacial acetic acid, and boiling the mixture for half an hour with ordinary nitric acid. No red vapours are evolved, and, on cooling, the whole sets to a mass of crystals, which after one crystallization from alcohol are obtained in a perfectly pure state.

Nitronaphthalene crystallizes in pale yellow needles, which when perfectly pure melt at 61° C. = 141·8° Fahr. The melting point, as given by Laurent, was 43° C. = 109·4° Fahr., which shows that the product, as obtained by him, was not pure. It may be taken as a rule, to which there are comparatively few exceptions, that the higher the melting point of a substance can be obtained, the greater its purity. It should, therefore, be repeatedly crystallized from any convenient menstruum until its melting point remains constant, this will indicate that all impurities have been removed.

For further details on the various nitronaphthalenes, the reader is referred to the writer's article on Naphthalene, in Watts's "Chemical Dictionary," Vol. IV., p. 4; also the Supplements, and Gmelin's "Handbook of Chemistry," Vol. XIV., p. 82.

Naphthylamine (C_{10} H_7 N).

This alkaloid, known also as naphthalidam, naphthalamine, and naphthalidine, was discovered by Zinin in 1842. He prepared it by treating nitronaphthalene dissolved in alcohol with ammonia and sulphide of hydrogen. It is now, however, always made by Béchamp's process, which consists in reducing nitronaphthalene with iron borings and acetic acid. The reaction is of a similar character to that which takes place in the reduction of nitrobenzene into aniline.

The apparatus of Perkin, for preparing aniline, described in this Journal, p. 552, may be used, or a still can easily be constructed for the purpose out of a flanged iron pot. It must, in the latter case, have a cast-iron agitator attached to a vertical shaft, capable of being rotated by steam power. If a steam-pipe be inserted and connected with a boiler, the apparatus can be used in Ballò's modification of the process, to be described presently. As violent frothing occurs during the operation, the still must be able to contain at least ten times the quantity of the materials used.

According to Schiff, the nitronaphthalene need not be crystallized from methylated spirit, as has been described, for its purification, but may be used at once after washing with water to remove adhering nitric acid. The cylinder, or still, is to be charged with 100 lbs. of nitronaphthalene and 150 lbs. of good cast-iron borings, and enough common acetic acid is to be added to cover the mixture. A gentle heat is then to be applied; this will cause the nitronaphthalene to melt, and the reduction will rapidly set in; the fire must at once be withdrawn, or the reaction will become so violent as to cause the contents of the still to boil over. When the action has moderated, the agitator may be set in action, and a gentle heat be applied until most of the acetic acid has distilled over. This acetic acid will contain naphthylamine. It may be utilized in subsequent operations, as was described under "Aniline." The heat being again moderated, solution of caustic soda is to be added to the still (the rotation of the agitator being constantly kept up) until the contents are strongly alkaline. The fire is then to be kept up, so as to distil over the aqueous portion of the contents of the still, and, finally, to be urged until the naphthylamine distils in the form of an oil. As naphthylamine acquires the solid form at temperatures below 50° C. = 122° Fahr., all the precautions required for the condensation of substances of this character must be attended to. As they have been more than once described in the "Treatise," they need not be repeated. As the temperature required for the distillation of naphthylamine is very high—viz., 300° C. = 572° Fahr.—the still must be so set as to be protected, as much as possible, from injury by the fire.

Although naphthylamine, when solidified, requires a temperature of 50° C. to melt it, it often remains liquid for a long time at ordinary temperatures.

To avoid the high temperature required in the distillation of naphthylamine as last described, M. Ballò recommends, after saturation with caustic soda as above described, to distil the base in a current of steam, taking care that the refrigerator is well cooled. This modification of the process would appear to be a great improvement upon the one first given; the only question which arises is the amount of steam required to effect volatilization of the base.

The naphthylamine thus procured contains impurities, amongst others phthalamine. Schützenberger and Willm remove the latter by converting the base into sulphate, and crystallizing from water. The sulphate of naphthylamine being more insoluble than sulphate of phthalamine crystallizes out first, leaving the sulphate of phthalamine in the mother liquors.

Perkin, who has made elaborate investigations on naphthylamine, dissolves the impure base in hydrochloric acid, filters the solution carefully, evaporates the filtrate to dryness, and distils the hydrochlorate so obtained with slaked lime. The base passes over perfectly colourless, and nearly pure.

Naphthylamine has a most repulsive odour, which persistently adheres to the skin. According to Cary Lea, some persons suffer in health after working at it for a long time. As far as the writer's experience goes, many persons, even after prolonged exposure to its influence, appear entirely unaffected by it.

Naphthylamine Violet.—Kielmayer (*Dingl. Polyt. J.*, cxcvi. 67; also Watts's Chemical Dictionary, First Supplement, 846) prepares this colour for calico printing, by boiling together 456 grammes of starch, 1·1 litre of water, and 118 grammes of dry naphthylamine dissolved in 1·5 litre of water and 79 grammes of hydrochloric acid of a specific gravity of 1·12, and adds to the liquid, after cooling, 13·5 grammes of chlorate of potassium dissolved in 0·3 litre of water. The printed goods are hung for three days in the oxidation-room, then drawn through a soda-bath, and, finally, through a soap-bath. The colour is thus developed into a pure violet shade. The result depends much upon the temperature of the oxidation-room, and of the dry-rollers, &c. Naphthylamine violet does not appear, like aniline black, to be the final product of a chemical process, but only a transition stage.

Scheurer states that the dirty-grey violet appearing on the fabrics as they come from the oxidation-room is turned to a purer violet by alkalies.

Blumer-Zweifel produces naphthylamine violet directly on the fibre, by printing linen or cotton stuffs with a solution containing, in a litre of soluble thickening material, 30 grammes of naphthylamine hydrochlorate and 15 grammes of cupric chloride solution of 15 Beaumé; this is equivalent to a specific gravity of 1·114. For dyeing, the thickening material is omitted, and the quantity of cupric chloride reduced by a fourth. If only 15 grammes of naphthylamine salt are used in the mixture, light shades are produced; 45 grammes, on the other hand, produce dark shades. The printed or dyed stuffs are left for two or three days in the oxidation-room at a temperature of 25° C. = 77° Fahr., and the colours are fixed by washing with soap water. Alkaline baths render the colour reddish; acid baths make it bluish.

Naphthylamine Red, Rose de Magdala.—This fine red colour, which is principally used for delicate pinks on silks, sells at a very high price. To prepare it, the hydrochlorate of naphthylamine is first converted into azodinaphthyldiamine by treatment with a slightly alkaline solution of nitrite of sodium or potassium. This method was first indicated by Perkin and Church. The product is identical with the amidoazonaphthaline of Griess. The azodinaphthyldiamine is then heated with naphthylamine and acetic or hydrochloric acid until the mass has assumed a red colour. The superfluous naphthylamine is removed by boiling out with hydrochloric acid, or by distillation in a current of steam. The residue containing the naphthylamine red is contaminated with a large quantity of a dirty violet substance. It is, therefore, repeatedly treated with dilute methylated spirit, in which the colour is more soluble than the impurities. The naphthylamine red is then purified by crystallization until the shade which it yields upon silk is sufficiently brilliant.

The reaction of nitrous acid upon naphthylamine may be written thus:—

$$\underbrace{2\,C_{10}H_9N}_{\text{Naphthylamine.}} + HNO_2 = \underbrace{C_{20}H_{15}N_3}_{\text{Azodinaphthyldiamine.}} + 2\,H_2O$$

The conversion of the azodinaphthyldiamine into naphthylamine red proceeds in accordance with the equation:—

$$\underbrace{C_{20}H_{15}N_3}_{\text{Azodinaphthyldiamine.}} + \underbrace{C_{10}H_9N}_{\text{Naphthylamine.}} = \underbrace{C_{30}H_{21}N_3}_{\text{Naphthylamine red.}} + NH_3$$

Compounds produced from naphthalene are also used in the preparation of other colours; but, for their history and properties, the reader must be referred to the standard chemical works, as the writer has already devoted more space than was originally contemplated to this sketch of naphthalene and its derivatives.

Reduction in the Price of Gas at Reigate.—The Directors of the Reigate Gas Company have reduced the price of gas from 5s. to 4s. 6d. per 1000 feet—the reduction to take effect from the March quarter.

Midland Association of Gas Managers.—The sixth quarterly meeting of this Association was held at the Midland Association, Birmingham, on Thursday, the 1st inst., under the presidency of Mr. Charles Hunt, of Birmingham. After the reading of the minutes of the preceding meeting by the Hon. Secretary, Mr. J. Tindall, of Walsall, a paper, "On Public Lighting, with Special Reference to Streets, &c.," by Mr. C. E. Jones, of Chesterfield, was read, and provoked an animated discussion. A full report of the meeting will be published in next Journal.

Communicated Articles.

THE CONTROL AND ASSISTANCE WHICH GAS COMPANIES MAY ADVANTAGEOUSLY EXERCISE OVER, AND RENDER TO CONSUMERS.

By Mr. A. F. Wilson.

Assuming that, in some degree, gas companies suffer undeserved odium from causes which might at least be partially, if not wholly removed, were it in their power to exercise an effective supervision over the consumer's fittings, and assuming also that the consumption of gas may be largely increased by a clear conception on the part of the consumer of the various uses to which it is applicable, and of the most efficient and economical methods of combustion, the difficulty is at once encountered of determining exactly to what extent it is advisable that companies should be entrusted with, and should exercise control beyond the meter, and also the information which it is desirable to impart to the consumer, and the best way of imparting it.

To arrive at any decision as to the first point, it becomes necessary to examine the various complaints from which this odium arises. These generally may be classed under the following heads:—

Insufficiency of Light . { Want of pressure or supply; low illuminating power; burners too small or too few.

Overcharge . . . . { Leakage from fittings; improper combustion; careless domestic management.

Beyond these there is the vitiation of the atmosphere by the carbonic acid resulting from combustion; but this complaint is felt equally with any other carbon-consuming light, and even the electric light is found to give off a gas of another description, probably more noxious and more objectionable in character. Accidents from explosion or otherwise may be left out of account, as the causes are usually carefully inquired into, and, in most instances, they happen from inefficient domestic management. Under the headings noted, therefore, are found the principal complaints, or causes of complaints, which require to be remedied, or which are remediable.

The problem is consequently narrowed, on the part of the companies, to the propriety of their personally interfering, with the view of remedying these complaints; and, granting that they are willing to do so, then, on that of the consumer, to what extent, without unfair sacrifice, the control of his fittings may be surrendered.

The companies have first to decide what, without incurring undue expense or responsibility, they can do more than is at present done. For example, complaint of bad light is met by the inspector applying a pressure-gauge to the service-pipe or outlet of the meter, which at once proves whether the supply at these points is satisfactory; the quality of the gas, of course, being as declared by the district examiner. A consumer complaining of overcharge is similarly referred to his meter, which has been stamped as correct by the government inspector, and he may be further reminded of his right to have it re-examined if he so desires. Is this sufficient? Probably, in the true interests of the companies, it is not. There is a proverb about locking the stable after the steed has been stolen, and every one knows that it is better to prevent the theft by locking the stable before. The consumer has certainly no right to blame the gas company for defects in his own arrangements; but the defects have been allowed to occur through his ignorance or that of his predecessors in the house, and when told that the company refuse to acknowledge any responsibility, he nevertheless refuses to acquit them, because he is not, from his imperfect knowledge, capable of justly discriminating in the matter. He possibly calls in some petty fitter, who makes matters no better, and increases the cause of his complaint by the presentation of an account for services rendered. The probability is, however, that he does nothing at all, but simply goes on grumbling, so long as matters do not become so bad as to be unbearable.

Now, a grumble such as this, added to others of a similar or kindred nature, constitutes in an important degree the unpopularity of gas companies, and probably they all might, at some time or another, have been prevented. No supervision, however, having been exercised, some one at some time had been over-greedy or over-economical. Where a considerable length of supply-pipe had to be carried, probably the diameter was diminished to save cost, instead of being increased to compensate for friction, and, with similar views, inefficient labour had been employed to do the work.

This being the state of matters in the past, the question is, how, without incurring undue responsibility or expense, to arrange so as to improve them in the future. At least two things seem to be necessary to this end first, that the gas companies should have a right of putting a veto upon, or, if this is not accorded, then of protesting against the employment of tubing of insufficient diameter, calculating the consumption of gas required at a given distance; and, secondly, that no gas-fitting work should be allowed to be undertaken by men who are incompetent gas-fitters. The man in charge of each particular job—not the head of the firm alone, or their manager, but the actual foreman workman—should bear a certificate of competency from the engineer of the gas company in whose district he works, or of some central authority applicable to all districts.

If a right of veto were accorded to the companies, then the first duty of this certificated fitter, upon undertaking a job or contract, would be to submit to the gas company the requisite information to enable them to judge whether their rules were being complied with. If only a right of protest existed, then this information might be given at any time previous to the supply being turned on. The right of veto would be most effectual; but it might be considered as an undue or over-strained interference, and might be abused. A right of protest would not be entirely ineffectual, as it would draw

attention to the company's recommendations while there was yet time to give effect to them, and a registration of this protest would be a continual check upon complaints which might afterwards be made. In any case, the furnishing of complete information should be a *sine quâ non*, and, having this, discrimination could be used as to what further steps might be necessary.

The information to be furnished might be contained in a condensed form, somewhat in the manner shown by the following table, it being understood that the figures noted are not calculated, but merely placed to show the proposed method. The remarks as to efficiency or inefficiency of the fittings would be written by the gas company's inspector in the space underneath, and the information and remarks might be retained in duplicate—one copy in a book of registry in the office of the gas company, and the other attached in some secure and convenient manner to the consumer's meter. When one or more of the branches from the main supply furnished secondary branches, the same form of card, marked "No. 2," would be suitable, with the alteration of the word "meter" in the second column.

Main Supply.		Probable Hourly Consumption.	Branch Pipe.		Probable Hourly Consumption.	Reference Number and Descriptive Position of Off-set.
Diameter.	Length of Branches starting from Meter.		Diameter.	Length to Lights.		
Inches.	Feet.	Cub. Feet	Inch.	Feet.	Cub. Feet	
2	80	150	¾	20	15	1. To Dining-room.
2	20	135	¾	30	15	2. To Kitchen.
1¼	30	40	¾	20	20	3. To Drawing-room.
1	20	10	½	15	10	4. No. 1 Bed-room.
¾	20	10	½	15	10	5. No. 2 Bed-room.
Remarks.						

The *rationale* of such a card is sufficiently obvious. A certain quantity of gas is required under minimum pressure at certain points. The question, therefore, arises—Is the diameter of the pipe sufficient, taking into consideration the distance to be travelled? Thus, No. 1 has the whole supply to deliver 30 feet from the meter; No. 2, 20 feet farther on, requires to furnish 135 cubic feet per hour; No. 3, 50 feet onwards, 40 cubic feet, &c. The assumption, of course, is, that there is a full supply at the meter, as, if it were not so, the gas company would be to blame.

It is probably no injustice to the ordinary gas-fitter to assume, that he is, to a great extent, ignorant of the principles which regulate the passage of gas in pipes. Few understand, or are capable of calculating the quantity of gas which, under a given pressure and diameter, a foot of pipe will deliver; but very few indeed are capable of making a calculation embracing the laws of friction in an extended delivery. Hence many of the complaints which arise, and hence also the necessity of endeavouring to have the work done in future by certificated workmen, who will have passed, not necessarily a hard examination, but one designed to ensure greater competency than is now shown in this class of artizans.

Besides keeping the consumer right by exercising some sort of control over his fittings, gas companies may, in their own interests, do something towards instructing their customers in the various uses to which gas may be applied; in the probable cost entailed in its employment for these purposes; and in the very best methods of its combustion, so as to ensure a maximum result with a minimum expenditure.

Success in trade depends to a great extent, not only upon having a useful article to sell, but also in making known as widely as possible the excellence and utility of that article. Gas companies have hitherto done too little in this respect. Consumers want information on many things, and whether or not it may be the duty of the companies to supply it, certainly it would appear scarcely doubtful that knowledge spread in this way would conduce to a greater consumption.

For this purpose, each gas company should either maintain a show establishment of its own, or, in the Metropolis, for instance, the various Companies should combine to keep a central one, easily accessible to the public. Such an establishment would, in fact, be a permanent exhibition of gas apparatus, and it ought to contain a sample of every kind of gas-consuming appliance approved as the best of its class. Reliable information as to the cost of working should be publicly exhibited, and advice as to points to be observed and avoided should be readily given, so as to ensure, as far as possible, a successful trial. Information might also be distributed in the form of descriptive pamphlets or catalogues of such appliances, containing as much explanation as a handy and inexpensive book of this kind could afford; but it is doubtful whether advice thus given would in many instances be properly studied, and, on the whole, probably the principal point to advertise would be the position of the show establishment, where the gas consumer would be patiently, intelligently, and fairly guided to the choice of an article which would thoroughly meet his requirements.

The consumer seeking an article of this kind may be supposed to ask several questions—viz., "Will it do what I want?" "Will it do it in the best possible way?" "Is it the best of its kind?" "What will be the cost of gas in working?" and last, though not least, "What is the cost of the article?" If the answer to this last query proves to him that the article he desires is beyond his resources, he must go without it, or the gas company, or some one else, must let it to him on hire.

Hiring appliances for the use of gas is now recognized by gas companies as a practical means of increasing the consumption, the only question being how far capital may be so expended, and to what particular kinds of apparatus to apply or restrict the system. Hitherto, in most instances, the line seems to have been drawn at cooking-stoves, and doubtless the enterprise of managers in recommending any extension to other apparatus has been, to a great extent, kept down by a feeling of responsibility on the part of directors in sanctioning, beyond unimportant limits, expenditure for purposes outside what might be considered their legitimate business. The time has now come, however, when a more decided course should be adopted. Either the gas companies should obtain the powers necessary to enable them to enter with spirit into the development of this extension of their trade, or they should facilitate the formation of other affiliated associations, which, untrammelled by parliamentary enactments, may work to the same end. Restricted by a sense of their responsibility in the expenditure of capital for unauthorized work, the development of the hiring system must necessarily be slow, but for the less costly articles there is abundant room to argue that the result would justify the means.

Next to cooking as a means of consumption—if not, indeed, of greater importance—are gas fireplaces. There is evidently a strong desire to adopt appliances of this kind as a means of diminishing domestic labour, but at present they are most imperfect. Asbestos is durable, but its appearance, when the fire is unlighted, is not pleasant. Fire-clay, with platinum wires, is better; but, except with stoves, it is not very successful—indeed, while gas-stoves generally are both economical and effective, fireplaces (which are the *desiderata*) are not. The reason is evidently that stoves part with their heat by radiation in the apartment to be warmed, whereas the heat generated in a fireplace is for the most part sent up the chimney, and the point to be aimed at as an improvement is to make a radiating stove in the form of an ordinary grate, with a current of air circulating at the back, and passing therefrom into the room.

The aim of gas companies should be to offer for hire only what people would be likely to decline to purchase, drawing the limit at costly apparatus, where capital employed would be greatly in excess of accruing revenue for gas. Power-engines, for instance, or steam-boilers heated by gas, would, if offered for hire, probably become most important consumers; but their cost would be so considerable as to place them beyond the scope of capital raised for non-risky purposes. Laundry stoves, stoves for offices, halls, and rooms without fireplaces, conservatory heating stoves, stoves for churches and public buildings, &c., might all, in certain circumstances, be advantageously hired; only, with such irregular customers and, indeed, as a principle throughout, it would be well to hire always with the option of purchase on easy terms, as the object should rather be to utilize the system as a means of introducing the consumption of gas, than to regard it as an investment, and endeavour to secure a considerable and lasting return for the capital invested. The purchase of an article of this kind is not generally kept account of; but the item of hire would, in fact, be added to the cost of the gas, and would have a somewhat similar effect, in preventing the popular use of the article, to that which would result from an increased price per 1000 cubic feet of the gas consumed.

The capital invested in gas property is now so important, and the inconvenience of violent fluctuations in the nominal value of such securities so considerable, that, apart from any consideration of an increased dividend, it is indubitably to the interest of gas companies to secure their position by an extension of the supply of gas for other than mere lighting purposes; and it would certainly do their property no harm if the public were taught to look with a little more kindly feeling upon them, and to recognize them as honestly-dealing traders, instead of exacting monopolists.

EXPERIMENTS WITH GENERATOR FURNACES.

III.

By "Isca."

The importance of experiments such as those described in the earlier portions of this article is unquestionable, whether in respect of their own particular scope and interest, or in view of the light which may be thrown on other subjects, sometimes little related apparently, by the records of observations carefully made and verified. Instances are common where the almost casual remarks of experimenters, respecting facts which came under their notice while engaged in some inquiry to which such incidents have been subsidiary, have been seized upon by other investigators, who have perceived their meaning in some widely different connection, and have followed to their proper application the hints thus obtained.

The danger in conducting experimental research is commonly found to lie more in the omission of necessary notes than in unnecessary amplification of them. This is made evident upon a careful consideration of the report which has been here examined. In one point especially, the report arouses curiosity, but does not satisfy it, and that is in mentioning the observed permeability of the brickwork of the generator furnace by air. That this is a fact is clearly stated; but, with all due respect be it said, the mere circumstance is not surprising, for the phenomenon has long been known. With the facilities which were apparently at hand for exact observation, it is a pity that when this effect was noted, and to such an extent that it was necessary to adduce it in evidence, in order to explain some otherwise conflicting or unaccountable results, some endeavour was not made to overcome it, or at least to determine its value, and so eliminate it from the problems to be solved, instead of leaving it as a disturbing element, to the prejudice of the conclusions ultimately tabulated.

Closely following on these qualifying considerations, and, in fact, forming part of the same train of thought, is the suggestion that the quantity of air intentionally admitted to the furnace should have

been stated with more exactness than by describing it as by one slit, or by two slits, or by a grate. Although some indications of this quantity may be observed in the varying proportions of CO and CO_2 in the gaseous products of combustion, it would be useful and instructive to verify these ratios by reference to actual volumes, which cannot now be done. It would be valuable to compare the volume of air drawn into the furnace at the bottom, by varying powers of draught, with the constituents of the effluent gases; and the information thereby obtained would be of great assistance, not only towards determining the velocity of air through the fuel which might be relied on for securing the best average effect, but would probably lead to a tolerably exact measurement of the air which penetrates through the brickwork of the furnace, by comparison of the theoretic constitution of the gases were that influence non-existent, with the composition as actually found by analysis.

The class of experiments which had as their object the determination of the quantity of steam which would, if introduced into the furnace, prevent the formation of clinker, or cause important modifications in its nature, is worthy of particular study. That this object was eventually attained is placed on record; but it will probably be somewhat surprising to many to learn that an observed admission of water in the form of steam, equal to 80 per cent. by weight of the coke consumed, was attended by no disadvantage to the constant maintenance of the action of the fire. It will probably be safe to assume that this could only be true in cases where the incandescent fuel exists in considerable depth, for otherwise the steam could not be reduced to its elements, which appears to have been the case here. The presence of free hydrogen in the gases carried forward from the regenerative chamber, at the same time that those gases maintained a temperature as high as, or even higher than had been observed when no steam was admitted, shows that a great amount of additional energy must have been developed in the chamber, in excess of that obtained without the steam, in order to effect its reduction *within the furnace*, and still pass on hydrogen unconsumed. That additional energy plainly could not have been due to the combustion of the effluent hydrogen, and the question arises naturally, where did it come from? If it was due to any combustion of hydrogen in the furnace, which thus yielded up its power before leaving the contact of the fuel, it is evident that the method adopted by the Commission, of estimating the total admission of water by the percentage of free hydrogen in the gases, was not correct, inasmuch as it could not include the portion consumed almost as soon as formed. If this hypothesis be rejected, the only solution possible is that the steam acted as a blast, and consequently caused a brisker current of air to enter the fire, just at the point where its own cooling action would be most marked, and by the same means would render the register of pressure in the gas channel misleading as an index of the quantity and character of the supply of air.

It is well known that the effect of water in a combustible, or of hydrogen and oxygen in the proportion in which they constitute water, is detrimental to the efficacy of the combustible as a source of energy. Now, steam is, of course, water, and the point offered for consideration is the difference observed between the effects produced by feeding a fire with fuel containing 80 per cent. of water, and by the injection of that proportion of water into the fuel when already heated to the full extent of its capacity. If the results, as to this point, observed in the examples which form the subject of this article, can be generally secured, a field of great promise is opened up to careful investigators. The impression which would be formed in the mind of any one, on a hasty glance over the descriptions of the experiments which are classified as presenting the effect of steady working, with the regular addition to the fire of about 80 per cent. of its weight of water, would naturally be that either the commonly accepted theory respecting the effect of the presence of water in a combustible is wrong, or that the recorded results of the experiments are misleading. Neither is the correct conclusion; nevertheless it would be highly desirable to make extended tests of this apparent action of steam upon heated fuel, when injected with the air admitted in the usual way.

Another interesting problem may be found in the question as to what became of the oxygen of the steam, of which the hydrogen was driven forward. Some of it was, of course, combined with carbon, forming one source of the carbon gases referred to. But did any of it enter into and change the constitution of the clinker? We are not favoured with the chemical composition of the clinker, either when formed in the dry process, and then, as we are told, extremely hard and solid, or in the porous and brittle condition to which it was reduced by the admission of steam. The Commission appear to have been content with the good results they secured in respect of its removal in the latter condition, and did not inquire very closely into the means by which that desirable effect was produced. We are consequently left in the dark as to whether the change was merely one of form or of nature; in other words, whether the steam acted by itself mechanically, or chemically by its components. This, again, if decided, would have indicated the part of the furnace wherein the clinker was formed; that is to say, in what gaseous envelope its formation may or may not be expected. The attainment of a perfectly clean fire, or one in which the carbon of the fuel is converted throughout into its gaseous compounds with oxygen, and the incombustible portions are left behind in the same independent particles, or nearly so, as must have existed before ignition, instead of fusing into a troublesome mass, is something so greatly to be desired, that anything which seems to offer the faintest indication of its probability is worth minute investigation.

These various suggestions, it is scarcely necessary to state, are made without the slightest desire to detract from the value of the experiments as recorded, or to ascribe anything but the most painstaking work to the Commission which organized and superintended them. Perhaps it was felt that the observations made were all that was necessary to afford intelligible bases for the opinions expressed. Still, it must be admitted—and the learned reporter, Dr. Bünte, of Munich, would probably be the first to assent to the remark—that perhaps the most valuable result of the labours of himself and his *confreres* is to be found in their suggestiveness, and that very much more remains to be done to render them perfect.

Admirable as far as they go, these investigations would seem to require supplementing to a very considerable extent, before the correlative questions raised by them can be considered even approximately solved. Whether this can be better done by a Commission or by individual effort, is a matter on which opinions may differ. A commission has many advantages of continuous and well-directed action, and its labours are always subject to the revision of many interested witnesses; but, on the other hand, a greater number of experimenters may be engaged, in independent but common research. Results are then abundantly checked, and incidental points noticed by many observers, and the entire field of inquiry is generally cleaner swept when there is a gradual advance along the whole line, than when a single brilliant charge sometimes captures an important position, but leaves a number of points unoccupied on either flank.

Correspondence.

[*We do not hold ourselves responsible for the opinions expressed by Correspondents.*]

DISCOUNTS ON GAS ACCOUNTS.

SIR,—I have noticed that you frequently advocate in the JOURNAL the system of allowing discount for prompt payment of gas accounts. I know from experience that it works well, but there is one serious objection to it. A company, under a Provisional Order, with the sliding scale and a standard price of, say, 5s. per 1000 feet, would be only entitled to divide 10 per cent. if they charged 5s., and gave 5 per cent. discount for cash. Possibly they might be satisfied with this, although 4s. 9d. per 1000 feet (which is really the same thing) would entitle them to 10¾ per cent. But suppose, from any cause, such as another "coal famine," the 4s. 9d. *net* would not earn the 10 per cent., it strikes me that very few boards of directors would raise the gross price above 5s., and so reduce the dividends for the sake of continuing the discount. Foreseeing this, there will, no doubt, be some reluctance to commence a system which would have the effect, for the purpose of the sliding scale, of making a company appear to charge more than they really do.

The Board of Trade have recognized the *principle* of discounts, by allowing in some Orders a "fine clause" for overdue accounts; but I cannot see how this could be put in force without causing much unpleasantness.

I should much like to have some information on this matter, as it is very likely to cause some difficulty in my own case.

May 8, 1879. A COUNTRY SECRETARY.

THE REGISTRATION OF GAS-METERS.

SIR,—In reply to Mr. Price's inquiry, in the JOURNAL of the 3rd inst., both legally and morally 1 per cent. only should be deducted from the account, and that adjustment should not extend beyond the commencement of the quarter in which the meter has been complained of. If the meter had been 3 per cent. slow, he would not have asked the consumer to pay that amount. A meter 2 per cent. fast or 3 per cent. slow is correct, and accordingly is stamped by the Inspector. LEX.

London, May 10, 1879.

SIR,—Replying to Mr. E. Price on the subject of the registration of gas-meters, permit me to say that "it is not in accordance with the Sales of Gas Act" to allow any deductions for a defective meter, but that the meter shall be changed at the Gas Company's expense, and the said defective meter-stamp destroyed. R. K. M.

May 10, 1879.

CALCULATING "FEET OF SURFACE" IN CONDENSERS.

SIR,—By your kind permission I should like to state that my apology is due to "M." for the mistake I made. The condensers referred to were designed, not, as I erroneously stated, for the City of London Gas-Works, but for the Great Central Gas Company, by Mr. Croll, their Engineer. W. C. BENNETT.

Gas-Works, Tiverton, May 9, 1879.

SALES OF GAS SHARES.—Last week a large number of original £2 shares in the Barton Gas Company were put up to public auction by Mr. E. Small, at the George Hotel, Barton. Lots 1 and 2 sold for £3 10s. per share; lots 3 and 4, at £3 9s. and £3 8s. Lot 5, consisting of 20 new preference shares, sold for 40s. per share; the remaining lots realizing at the rate of 39s. per share. Five original £5 shares (£3 paid) in the Barrow Gas Company, sold at the same time, fetched 57s. per share. On the 2nd inst., Mr. R. Hall offered for sale by public auction, at the Masonic Hall, Lincoln, improvement stock to the value of £114 in the Lincoln Gaslight and Coke Company, which realized £117.

THE SOCIETY OF ARTS CONFERENCE ON "NATIONAL WATER SUPPLY, SEWAGE, AND HEALTH."—This Conference will be held in the Rooms of the Society of Arts, on Thursday and Friday next, the Right Hon. James Stansfeld, M.P., late President of the Local Government Board, in the chair, assisted by the members of the Executive Committee. The Conference will meet each day at 11 a.m., and sit till 1.30; then adjourn till 2, and sit again till 5 p.m., and, if necessary, meet again at 8 p.m. The proceedings will be opened on Thursday by an address from the Chairman, and the papers and discussions will be taken under the following heads:—1. Methods of securing a sufficient supply of pure water. 2. Evils of impurity, and consequent connection of the question of water supply and sewage. 3. Methods of sewage, &c. There will be an exhibition of mechanical and chemical apparatus in connection with water supply, treatment of sewage, and health. The exhibition will be open from 10 till 8 on Thursday, and from 10 till 5 on Friday.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, MAY 5.

Rawmarsh Local Board Bill.—The Chairman of Committees informed the House that the opposition to this Bill had been withdrawn.

The Examiners reported that no further Standing Orders are applicable to the Birmingham Corporation Water Bill.

The Tipton Local Board Bill was reported, with amendments.

Petitions against the Birmingham Gas Bill were presented from (1) Corporation of Birmingham, (2) Solihull Rural Sanitary Authority.

A petiton against alteration in the Manchester Corporation Water Bill was presented from the Corporation of Wigan.

TUESDAY, MAY 6.

The Westgate and Birchington Water Bill was reported without amendment.

THURSDAY, MAY 8.

The Llandudno Improvement Bill was returned from the Commons agreed to, with amendments, which were considered and agreed to.

Petitions against the following Bills were presented:—Manchester Corporation Water, from Jacob Birkett; Southend Water, from London, Tilbury, and Southend Railway Company.

FRIDAY, MAY 9.

Manchester Corporation Water Bill,—reported specially from the Select Committee, with amendments.

Brighton and Hove Gas Bill.—Queen's consent signified, and Bill reported from the Select Committee, with amendments.

Glasgow Corporation Water Bill,—reported from the Select Committee, with amendments.

Dudley Sewage Bill,—reported with amendments.

Portsmouth Water Bill,—reported without amendment.

Birmingham Corporation Water Bill, Bromley Gas Bill,—read a second time, and committed.

Westgate and Birchington Water Bill,—read the third time, and passed.

HOUSE OF COMMONS.

MONDAY, MAY 5.

Colchester Water Bill.—The Examiners report—"That the Standing Orders have not been complied with in the case of the petition for additional provision in the Colchester Water Bill," was referred to the Select Committee on Standing Orders.

Gas and Water Provisional Orders Confirmation Bill.—The Examiners reported that the Standing Orders applicable to this Bill have been complied with.

The Colwyn Bay Water Bill was read a second time, and committed.

London Sewage.—A petition from Plumstead, for inquiry into the non-completion of the works, was presented.

Requisitions to withdraw their petitions against the following Bills were presented:—Ilkley Gas, from the Postmaster-General; Lancaster Gas, from the London and North-Western Railway Company; Nottingham Corporation, from the Midland Railway Company; Over Darwen Corporation, Queenstown Gas, Warrington Corporation, and Wombwell Local Board, from the Postmaster-General; West Kent Main Sewerage, from the Dartford Rural Sanitary Authority.

TUESDAY, MAY 6.

Llandudno Improvement Bill,—read the third time and passed, with amendments.

Houghton-le-Spring District Gas Bill,—as amended, considered; to be read the third time.

Bills read a second time, and committed:—Blackpool Extension and Improvement, Leicester Corporation, Newcastle-upon-Tyne and Gateshead Gas, South Shields Gas.

Requisitions to withdraw his petitions against the following Bills were presented from the Postmaster-General:—Preston Gas, Stourbridge Gas, Wisbech Gas.

The Derby Improvement, Plymouth and Stonehouse Gas, Preston Gas, Stourbridge Gas, and Wisbech Gas Bills were referred to a Select Committee, consisting of Mr. Otway (Chairman), Mr. A. Smith, Captain Hood, and Mr. D. Taylor; to meet on Tuesday, May 13.

The Morecambe Gas, Alliance and Dublin Consumers Gas, and Lancaster Gas Bills were referred to a Select Committee, consisting of Mr. Percy Wyndham (Chairman), Sir Richard Wallace, Mr. D. Jenkins, and Mr. Stanton; to meet on Tuesday, May 13.

WEDNESDAY, MAY 7.

Requisitions to withdraw their petitions against the following Bills were presented:—West Kent Main Sewerage, from the Erith Local Board; Wombwell Local Board, from the Elsecar, Wentworth, and Hoyland Gas Company.

Preston Gas Bill.—The *locus standi* of the following petitioners against the Bill was disallowed:—(1) Walton-le-Dale Local Board; (2) Corporation of Preston, except as against clause 6.

THURSDAY, MAY 8.

Gas and Water Provisional Orders Confirmation Bill,—read a second time, and committed.

Requisitions to withdraw their petitions against the Nottingham Corporation Bill were presented from (1) Thomas Alfred Mann, (2) Thomas Moore and others.

FRIDAY, MAY 9.

Colchester Water Bill.—The Standing Orders Committee reported "That in the case of the Colchester Water Bill, petition for additional provision, the Standing Orders ought to be dispensed with; that the parties be permitted to introduce their additional provision, if the Committee on the Bill think fit."

Houghton-le-Spring District Gas Bill,—read the third time, and passed.

Arlecdon and Frizington Water Bill,—as amended, considered; to be read the third time.

Over Darwen Corporation Bill.—The Examiners reported that the Standing Orders have been complied with in the case of the petition for additional provision in this Bill.

Bills reported:—Aire and Calder Navigation, Ilkley Gas, Imperial Continental Gas Association, Mirfield Gas, Warrington Corporation, Weardale and Shildon District Water.

A petition was presented from Henry Rose (from himself and the Rev. Edward Penrose Hathaway and John Pennington Legh) against the petition for additional provision in the Knutsford Light and Water Bill.

A petition (the petitioners not praying to be heard) was presented against the Over Darwen Corporation Bill, from Inhabitants, owners, and occupiers of property and ratepayers of the township of Eccleshill.

A requisition to withdraw their petition against the Newcastle-upon-Tyne and Gateshead Gas Bill was presented from the Corporation of Newcastle-upon-Tyne.

LONDON GASLIGHT COMPANY BILL.

On the motion of Sir CHARLES FORSTER, the order that this Bill be committed was read and discharged, and the Bill withdrawn.

THE SELECT COMMITTEE ON LIGHTING BY ELECTRICITY.

SECOND DAY—TUESDAY, APRIL 29—(*continued*).

(Members present: Dr. Lyon Playfair, in the chair; Mr. Adam, Mr. Alfred Gathorne-Hardy, Mr. Hardcastle, Mr. Mitchell-Henry, Mr. Heygate, Lord Lindsay, Mr. Arthur Moore, Earl Percy, Mr. Pulestón, Mr. Spencer-Stanhope, Mr. Christopher Talbot.)

Mr. *Conrad William Cooke*, examined by the CHAIRMAN.

I am a Civil and Consulting Engineer, a Member of the Society of Telegraph Engineers, and of the Physical Society of London. I was the first to receive the Gramme machine into England. It was brought over in 1872 by Mr. Werdermann, at the instance of Sir Charles Wheatstone. In 1873 I designed the apparatus that was used in the clock tower of the House of Commons. The special difficulty in connection with it was due to the fact that, it being a signal light to show that the House was sitting, the slightest cessation of the light would be a signal to Members outside that the House was up; and the First Commissioner of Works made it a *sine qud non* that the light must not go out for a moment. At that time there was no special lamp that would burn for more than four or five hours. We had to deal with what lamps we had, and I designed a special apparatus by which the lamps could be instantly changed, and during the process of changing, the incandescence of the lamp which had just been put out was sufficient to carry the light on to the next lamp, which replaced it in the apparatus. It was described at the time, and it was a novelty in that respect. The light in the tower was tested against Mr. Wigham's system of gas illumination, such as is used by several of the lighthouses on the Irish coast. It consists of a great many gas-jets in a group, with a chimney above to produce a great draught. In fact, it may be called three small gas-furnaces placed one above another. At present they have a smaller arrangement with only two. The tower is now lighted again by means of gas—the same system, but not with so powerful a light. There are two lamps instead of three, and each lamp has 68 burners instead of 108. The Corporation of the Trinity House ordered experiments to be made; and both photometric experiments in the vaults of the House, and also from Primrose Hill and several other distant parts of London, were carried out by Sir Frederick Arrow and Mr. Douglass. These gentlemen prepared a report, which was very favourable to the electric light, as far as power was concerned, but the question of cost came in, on account of the attendance required for it. It being in an exceptional place, at the top of a high tower, a man employed there could hardly do other work, and the cost became exceptionally heavy for that reason. They required a skilled man, who understood the machinery, without the whole of his time being filled up, and therefore it became very expensive. During the last few years I have made a special study of the progress of invention with regard to the electric light. I have taken a great interest in it, and I have also done so with regard to contributing to the literature of the subject, and preparing descriptions which have appeared in the scientific journals, especially in *Engineering*. I think the electric light might be used as a supplement to gas in most cases, and also as a perfect substitute for gas in certain special cases, while in a third set of cases it cannot compete with gas at all, and gas must hold its own, without any opposition from electricity. I think the electric light is applicable for the illumination of the interiors of large buildings, such as the Albert Hall; for such large passages as the lobbies of this House, or the House itself; for open spaces, such as Charing Cross, and large squares, such as the Place de l'Opéra, in Paris, and places of that sort; and again for light-house illumination. For any large space, in fact, that is not very much cut up with obstructions to give shadows; and even in cases where there are obstructions, of such a nature as a common factory, where there is no decoration, so that you could whitewash everything; even a factory full of driving belts and gearing of every sort. I have been in factories where, by whitewashing every part that could be whitewashed, you hardly noticed any shadows whatever. In those cases the electric light may be applied. In other cases, where there is decorative work, the light may be thrown through a skylight on to a light ceiling or a white screen. In those cases I think it cannot be met at all by gas. There are cases in which the electric light is supplementary to gas. Take the Albert Hall as a building. The inside of the hall is perfectly lighted by the electric light; and I will say more than that—it would be more perfectly lighted if the gas were put out in the hall, for reasons which I shall be prepared to give, if necessary. But for the rest of the building, for the passages and corridors, I do not think that electric illumination would be of much use. They are so curved and twisted that the electric light would be very costly, and you would require to have a great many separate lights, whereas gas is very easy of application, and more convenient. Then there is a third set of cases in which electric lighting could not be applied at all; that is to say, in the poor and narrow streets, and in small shops and buildings generally. When I say that it could not be applied, of course I mean in its present aspect, according to the systems at present in use. I cannot see that it can be applied to small houses, or to domestic purposes, except in libraries of palatial houses, or large rooms. But there must be an enormous number of places of small area which cannot be lighted by the present system of electric lighting.

The CHAIRMAN: Supposing that electric lighting became at all a general source of street illumination, have you considered whether it might not interfere with the telegraphic communication of the country?

Witness: I think that if some provision were not made for protecting telegraph lines from the effects of induction, it would have a very injurious effect indeed if the lines carrying the electric currents for the light ran at all in a parallel direction with the lines carrying the telegraphic circuits; but, at the same time, there are means for getting over that entirely by compensating it. One way would be to have a return wire for the electric light instead of using the earth. Those places only would be affected where the electric light circuit runs in a parallel direction to the other; it would not affect the telegraphy of the country which goes along the railways, because I do not take it that it is at present the idea to light the railways by electric light, having a central power station at one end of the railway. If they lighted railways, they would probably have their machines at each station, or at every two stations; and in that case they must not carry the electric light wire parallel with the telegraph lines without compensating it.

At what distance between the wires would a telegraph wire be influenced by induction?—Theoretically, at an infinite distance; but the influence diminishes, of course. If it is carried a long way off, practically there would be no induction; but you have, on the one hand, a powerful current,

the most powerful current known, to produce the electric light; therefore it must have more effect at a greater distance than a weak current. Taking a practical distance, such as a street, I certainly think that, without compensation, wires for the electric light buried in the street would influence the telegraphic wires buried in the same street. Compensation could, however, be provided without any great inconvenience.

Have you any information in regard to the relative cost of the two different systems of lighting?—I have. The most accurate document that has as yet appeared in connection with the cost of street illumination, is the report of Mons. Cernesson to the Municipal Council of Paris.* Trials of the Jablochkoff system were made with the greatest possible care, extending over some months, and everything was taken into consideration that could possibly influence the result, and really a very magnificent report, in a scientific sense, was produced. It had always been reported that the Jablochkoff system needed a 1-horse power engine per light. The experiments in Paris showed that it was 20-horse power for 16 electric candles, the value of which, as they stand with their globes on—and the globes absorb a very large amount of light, something like 60 per cent.—as measured in a horizontal plane by Mons. Allard, is 18 Carcels, equal to 167·4 candles. A Carcel is about 9·6 candles. Of course, the horizontal plane is the most brilliant, because there is no shadow at all from the tip of the carbon; but when the light was placed at the level of the pavement, it was reduced to 12·1 Carcels, or 112·5 candles. That gives a total mean illumination, for the 62 lights, of 6975 candles, and the cost came out to be £1 9s. 9d. per hour, distributed over 62 lights. The cost of the lights in the Avenue de l'Opéra, including the Place de l'Opéra and the Place du Théâtre Français, including wages, steam power, oil, and candles, at 50 centimes per light per hour, averages £1 19s. 4d. per hour, or 7¾d. per light per hour. At midnight the lights are put out, and then the streets are illuminated by 344 gas-jets, each giving a light of 10·2 candles, producing an aggregate of illumination equal to 3519 candles as against 6975, or less than half. The cost of those 344 gas-jets is 5s. 9d. per hour, or a little over one-fifth of a penny per light per hour, as against 7¾d.; so that the illumination of the Avenue de l'Opéra to a given photometric degree costs for the two sets of lamps as there installed (because they are not at the best advantage) more than two and a half times more when effected by electricity than by gas. But the Jablochkoff system is a costly one, because it is one of the dividing systems; and although it is excessively convenient for certain purposes, there is an enormous loss in all systems of division.

In this case you have very much the same as a single light in the Albert Hall divided into 62 different lights—that is to say, you have a 6000 or 7000 light power divided into 62 lights?—Yes; and at the Albert Hall it is far cheaper than gas, because there you have a central light, and you are not losing the enormous amount which you do by all systems of division. It is the system of division which makes the Jablochkoff method a costly one; and I think that the same must apply to all systems of division, of which the Jablochkoff is decidedly a convenient one.

Have you any other information which you could give to the Committee relative to the cost of the various systems? Dr. Siemens's evidence with regard to the Albert Hall was that the electric light there was equal to 30,000 candles, and that 43,000 cubic feet of gas were burnt for the illumination of the hall when the electric light was not there. Is that the same information as you have?—I have the sum actually paid for the cost of the five lights of 6000 candles each. The coal comes to under a ton; you may call it a ton, and put that down at £1; the carbons come to about 10s.; wages about 10s.; wear and tear, 10s.; that makes £2 10s. for the four hours, or 12s. 6d. per hour. To that must be added interest on capital, which is about £800; but that I take to be well balanced by the interest upon the capital represented by the gas-fittings and pipes in such a building as the Albert Hall.

In the present system of electric lighting there is a tendency to fluctuation in the light. What is your opinion of the cause of this fluctuation?—I think that the chief cause of the fluctuation is undoubtedly the difficulty of getting really reliable carbons. We want a perfectly homogeneous carbon, and if you get that you will have a good lamp and a steady light; but the carbons are difficult to get. I ought to mention that there is another cause of the fluctuation—for I quite corroborate Dr. Siemens's statement that we have not yet got so perfect a lamp as we have a machine—I think another cause of fluctuation is, that we want a thoroughly good reliable lamp, though there are many which show very promising results.

Have you anything to suggest to the Committee as to the arrangement of the lamps?—With regard to the arrangement of the lamps, I think there can be no question that you cannot lay down one law for all cases; you must put your lamps to suit the special case. For factories and workshops, where you can whitewash everything, it is much better, if you can, to throw the light away from the eyes, and on to a whitewashed space, and use the light reflected from those surfaces. In large halls, if you have a height to deal with, such as you have at the Albert Hall, which I think is 150 feet from the floor, you can put the lights so that they do not interfere with your eyes at all, unless you look up. The Duke of Sutherland suggested a beautiful method, which was shown at the Institution of Civil Engineers a short time ago, in which a vertical parabolic reflector is placed upon the lower carbon, and the lower carbon comes through the centre of it. This throws a vertical beam of intense rays on to a white screen placed above it, giving a most splendidly diffused light. If you have to put your lights low by reason of the nature of the place, or if you want the lights near, as you do in street illumination, you must put globes, or some sort of distributors, such as a globe, around them, otherwise you get the light rather glaring; but in that case you lose a certain amount of light. Now, if you put a plain glass globe, it absorbs 10 per cent. of your light, leaving you 90 per cent. to go on with; and your glass globe is of very little use except for keeping off the draught. If you have ground glass, it absorbs 30 per cent. of your light, and you have 70 per cent. to deal with. But in the Jablochkoff candle they have opal glass globes, and these absorb 60 per cent. of the light, giving you only 40 per cent. Then there is another question. In a lighthouse, where you want a light all round, you would place the carbons in the same vertical axis with one another, because you want the light as much as possible to be uniform; but Mr. Douglass and Dr. Tyndall, in their experiments at the South Foreland, with regard to the comparative merits of different systems, found it to be an enormous improvement, in a case where you want to send the light in a particular angle of azimuth, to place one carbon in front of the other, and not in the same vertical axis—that is to say, to place the centre of the lower carbon vertically below the front edge of the upper one. In that case you get the light thrown forward, and the upper carbon wastes away laterally and unsymmetrically, and forms a sort of incandescent source of light behind the arc, which throws the light more forward. Taking a circle round a light of that sort, the photometrical experiments seemed to show that if 287 represents the intensity of the light in front, the intensity at the two sides would be 116, and at the back, where the light is not wanted, it would be 38; so that you clearly gain a very large amount in the direction in which the light is required. That, of course, will apply to all cases where you require the light to be projected in a particular direction. Another thing is that a great deal has been said about a sort of cadaverous effect that electric lighting has in halls, and it has been said that it is due to the blue nature of the electric light. I do not think that it is due to that; I do not think that the electric light is blue. The spectrum of the electric light is remarkably like the solar spectrum, which we take to be our standard of white light; and if it were a distinct blue light, we should have a very large proportion of blue in the spectrum. But in illuminating halls at night, first of all, everybody is used to the gas; and if you are used to gas, and you come into a building and see a white light, in contrast to what you are used to, you think it looks blue. But there is another effect which is this: I mentioned just now that I think the Albert Hall would be better lighted if there were no gas at all. If you illuminate a surface with two coloured lights, both shining on it at the same time (we will take a red and a green light for the sake of example), it is perfectly clear that what is shining on that surface is a mixture of red and green. Now, if you cast a shadow from one light on it, it cuts out one and leaves the other. Therefore the shadow from the red light will be green, and the shadow from the green light will be red; and if you have gas and electric light both illuminating a building together, the parts that are in shade from the one light would have the colour of the other light, and *vice versâ*; so that the parts in shadow will be of a bluish description, or of a greenish description, as Dr. Siemens said, and the other will be red; and no doubt that would have a very unpleasant effect. I think if the place were illuminated by a purely monochromatic or rather white light, you would not have those effects. With regard to the application of divided lights, I think the division of the current causes such a great loss that there are only very exceptional cases where it can be applied with any advantage; but there are certain cases where expense is not such an object. For instance, in the British Museum we have a building which, without the electric light, is practically useless after dark; and it is well worth while to go to the expense of illuminating it. It is a question of light or no light, and not of gas against electricity; and I think, in such a case as that, a divided light is of advantage, although a central light at the top would illuminate the place extremely well. Still I do not think, in a case of that sort, expense is very much an object.

At the present moment, what are the common motive powers employed for producing the electric light?—Steam-engines, of course, are the most common of all, but with regard to gas there is no doubt whatever that a gas-engine for electric light is a very important and a very useful thing. It seems as though the electric light cannot start without offering some compensation to the gas interest which it takes away; for there seems to be, for ordinary purposes, for lights that are only wanted for a few hours, nothing that is so good as a gas-engine. You turn on your gas, and you start your light. In fact, take the case of a building such as the Houses of Parliament. A dark November fog comes on suddenly; the steam may or may not be up. If it is up, you may have your light; if it is not up, you have to wait for it. But with the gas you have it instantly, and there is no loss of fuel when you turn it off. Hot-air engines, or rather caloric engines, are used for certain special cases where it is difficult to obtain gas, and where it is also difficult to obtain steam-engines. Then, again, Sir William Armstrong lights his library at night by a dynamo machine, driven by a waterfall nearly a mile from the house, and it drives machinery in the daytime. Then petroleum engines are used for the same purpose. I think that the extension of the use of gas-engines which would be brought in by the extension of the electric light would be a very important thing for the gas people. Considerably more gas would be required to drive engines than would ever be used for lighting a place by the ordinary means. Dr. Hopkinson made a very interesting calculation in reply to the question: "If you have 100 cubic feet of gas to start with, in what way can you make it produce the greatest amount of light in an hour?" He said: "If burnt in the ordinary way you get about 300 candles out of it; and if burnt in a gas-engine to drive a dynamo-electric machine, it would generate 3-horse power." Now, 3-horse power will drive a Siemens machine which will produce 3000-candle power; that is 3000 against 300, or ten times the light from the burners. He also made a similar calculation as to petroleum. Starting with half a gallon of petroleum, and burning that for an hour, it would produce 700 candles light burnt in lamps. If that half gallon of petroleum were burnt in a petroleum-engine at the same rate, he believed that it would develop 5-horse power; and 5-horse power, of course, would drive a very powerful dynamo-electric machine, and a proportionately enormous increase of light would be produced.

Then you think that the scare which at one time arose that the electric light was going to extinguish gas light was not justified?—I do not think it was, for there can be no question that, if the electric light comes into general use—and it can only come into general use for those places where it is practicable—it will leave a large number of places where it is not applicable; and, if you illuminate one street by the electric light, the side streets and those near it, cannot afford to be in the dim darkness of the poor lighting that they now have, and they must burn more gas. If one theatre has the electric light, the other theatres will have to burn more gas, and in every case you will find that the standard of illumination will be raised; therefore, more and better gas will be employed. There was exactly the same scare about candles and oil when gas came in, about 80 or 90 years ago. With regard to candles, there can be no question that since the introduction of gas we have had far better candles than we ever had before, and oil and all those things have improved. I think that it is due to a great extent to the competition of gas, and also to the raising of the standard of illumination. Our forefathers were accustomed to the wretched rushlight. If a better illuminant comes in, it is necessary for everybody to have that better illuminant, and the others go to the wall. It is the survival of the fittest; and I think that the effect must be the same on gas, that if the electric light comes in the gas companies will congratulate themselves on a friend rather than an enemy coming to them.

In fact, through the electric light, they may get much more power and much more illumination out of their gas than they have had hitherto?—Quite so. Then again the supply of gas for gas-engines will be a very important item; and they will have to prepare a different sort of gas. The gas for lighting is not the best for heating, and it is not the best for gas-engines, which are used for explosion. The gas for lighting ought to be exceedingly rich in carbon; the gas for heating and for explosion should be excessively rich in hydrogen, because you thereby get a greater explosive power; and the probability is that they will have to supply two sorts of gas, an illuminating gas, and what we might call a motive gas. In that case it would be necessary to lay down separate mains for the purpose, and that must, I suppose, be a good thing for the gas companies, because they would have a double source of supply instead of a single one. Then, again, retort carbon will become more valuable, because the amount in demand for making carbon pencils will be so increased; and the carbon comes from the gas-works originally. It has been said that gas can be made for nothing; that is to say, that the products of combustion will pay for the cost of its manufacture. I think that the extension of the electric light will increase the demand for retort carbon, and raise the value of one of the products, at all events.

* A translation of this report appeared in the JOURNAL for Jan. 21, p. 88.

THIRD DAY.—FRIDAY, MAY 2.

(Members present: Dr. Lyon Playfair, in the chair; Mr. Mitchell-Henry, Sir U. Kay-Shuttleworth, Lord Lindsay, Mr. Arthur Moore, Earl Percy, Mr. Puleston, Mr. Spencer-Stanhope, and Sir David Wedderburn.)

Mr. *Conrad W. Cooke*, recalled and further examined.

By Lord LINDSAY: In addition to my practice as a consulting engineer, I prosecute scientific researches on my own account. Extreme regularity in a motor is of the highest importance in obtaining a steady electric light. Any variation in the speed of the engine means a variation of the strength of the current, which will not only cause a vibration of the intensity of the light, but will quite disturb the correctness of the lamp for a particular strength of current. If a lamp is adjusted for a certain strength of current, and you lower or increase the speed of the machine, the lamp will probably begin to go wrong. A sudden short-circuiting of the current would immediately throw a very enormously increased amount of work upon the machine. It would very largely decrease the magnetic field, and, consequently, the force to tear through that magnetic field would be largely increased; and, in fact, it would be very like putting on a brake. Again, if a carbon splits and breaks off, the current is interrupted, and then the lamp must take some time to run together again; and during the time that no work was on the engine would race. This would be automatically regulated in the case of gas-engines. The Crossley silent engine is the only one as to which I have any data. I do not know the capabilities of other engines in that respect; but, certainly, the Otto silent engine, or the Crossley silent engine, as it is called, is wonderfully well adapted for electric lighting. The control is very complete indeed. My experience leads me to corroborate the statement made last Tuesday, that our means of developing the electric current are considerably in advance of our means of utilizing it in the practical form of lamps. If you take the carbons as part of the lamp, you may almost say that very nearly the whole of the difficulty of the electric light rests in the lamp. The carbons, perhaps, are the chief difficulty; but even assuming that you can get good carbons, there is a vast amount of difference in the different lamps. There are an enormous number of different lamps. At the Paris Exhibition last year, I think there were between 40 and 50 different systems of lamps exhibited, and that represented but a portion of the lamps then in existence, which shows that the difficulties and defects in the lamps have led inventors to try and improve them. [Witness then described the various lamps that were on the table in the committee-room.] I cannot speak with any practical experience of the question of obtaining light by means of incandescence, necessitating a closed circuit. My view of it is that you would have a far greater loss. It could not be done so economically, but it would probably be applicable in cases where economy was not so much an object, and where there was some special reason for dividing it. Assuming a street to be worked on this method, the street being joined up in a series, and supposing that the occupier of one house wished to put out his lights, you must throw into the circuit a resistance exactly equal to what you cut out. If you do not do that you will affect every lamp in the series, and the machine as well. If you put out your lights by breaking the circuit, you put out every light in the circuit. If you put them out simply by short-circuiting them, you will make the others much brighter; or you will make the engine run away if is not properly controlled. The cost of a lamp working and one at rest would be the same, with the exception of the carbon which was not consumed. I think that a contrivance might be made for the purpose of learning the quantity of electricity which would be used in a given space of time by the occupier of a house, although it would be somewhat difficult to meet all the peculiarities, for instance, of a man shutting off the whole of his house, or shutting off one light, or two lights, and so on. You would probably require to have a meter almost at each light. I think that for judging the intensity of the electric light it is desirable to have a standard of higher photometrical power. At the same time, there is a difficulty, and it is that of comparing a large light with a very small one. An electric light is of small magnitude, and if you have a very large flame to compare it with, you introduce difficulties. I think that the lighting of large areas, such as squares and buildings, and large halls, by the electric light, would give a decidedly economical result; but, in the present state of science, my answer would not be so decided with regard to small spaces, and with regard to domestic consumption.

By Mr. PULESTON: There is no doubt whatever that there is a very small amount of heat given off by the electric light, although the intensity of the heat at the point is enormous, so much so that the most refractory metals, such as platinum, melt in it like wax. But its radiant power is very small. It is a very small area to start with, and it is a great deal in a vaporous condition, by which its radiation is largely reduced; and, again, what it gives off in the form of deleterious vapours is so very small. One small carbon will give the same light as an enormous number of gas-burners; and, therefore, as regards the sanitary effect, the advantage is largely on the side of the electric light. I think that, for any building, you may take it that the heat from the electric light that will replace the gas for illuminating is absolutely inappreciable. In the very smallest room I think the electric light could hardly warm it in the least. The electric light, as far as it has gone, is not practicable for street lighting. I do not think we have any system except for broad streets. I do not think the time has come when we have any apparatus that would be thoroughly satisfactory to a corporation for lighting the ordinary narrow streets of a town. The fact that the electric light cannot be subdivided is one of the difficulties in its practical use now in street illumination, and it is the insuperable difficulty at present as regards domestic illumination; but, for the illumination of large halls and large areas, I think that centralization is better than subdivision. I remember the experiments that they tried in Billingsgate Market. A great many causes of the failure there were given. Those who were in favour of the gas said that it was an imperfect light; that it was unhealthy; that it made the fish look bad, and a great many other things. Those, again, who were in favour of the electric light said that the Billingsgate people did not like their bad fish to be shown up. It is impossible to give a real reason in a case of that sort.

Mr. SPENCER-STANHOPE: With respect to divided currents, or a number of lamps for private use, I think I gather your opinion to be, that at present the working of the electric light is not sufficiently developed to make that practicable in a pecuniary point of view?

Witness: I think that, generally speaking, it is not so; but the Wallace system is, perhaps, the best one for dividing with an arc. It is due as much, perhaps, to the lamp itself as to the machine with which it is used. The Wallace-Farmer machine is one which gives a tremendous current. It has an enormous electro-motive force, and I think it is more able to get over the resistance than any other system.

Mr. ARTHUR MOORE: I presume the electric light would be much safer in a large drapery establishment than having a great many jets of gas in every direction?

Witness: Very much so. First of all, you entirely eliminate all danger of explosion, to which you are liable in the case of gas; and the only danger of fire is from the splitting off of little bits of carbon, and that is very easily protected against by putting a wire gauze underneath; so that you need not consider that. In a shop in the Strand they put a dish of water underneath the light, and the water being transparent, it does not obstruct the light, and it also quenches any little bit of carbon that falls in; but there is no danger whatever of fire from it.

Sir DAVID WEDDERBURN: You said, I think, that the amount of heat produced by the electric light in a room was almost inappreciable; would you say that the amount of vitiation of the atmosphere produced by the electric light in the way of consuming oxygen, or producing carbonic acid, would also be inappreciable?

Witness: Quite so; in fact, you can almost say that there is next to no consumption of oxygen. The electric light will burn as well in a vacuum as in air. There is a certain amount of carbonic acid, of course, produced, because you are destroying carbon, and if you destroy a solid form of carbon it must go into something; but the amount of carbonic acid produced would, I think, be altogether inappreciable.

Is the electric light nearly the same in colour as the solar light, and is the apparent blueness of it due to the fact that we almost always see it in contrast with gas?—I think the spectra are very much like one another. The spectrum of the electric light is really purer than the spectrum of the sun. The sun has many dark hues in it which the electric light has not, representing colours which are missing.

Mr. MITCHELL-HENRY: There is a limit, is there not, to the power of a gas-engine? You cannot depend upon it beyond about 6 or 7-horse power, can you?

Witness: 16-horse power is the largest that I have a note of; that is Crossley's engine, which works up to 24-horse power.

But whatever engine you use for the electric light, you must, of course, have a great deal of reserve power in the engine?—Not a great amount, though you must have more power than what it takes to drive the machine; but I think that applies to every sort of mechanical work that you can do. In the case of a horse pulling a carriage, the principal strain is in starting, and overcoming the inertia, and when you have once done that, if you can get a start given to the carriage you need only have a smaller power to keep it going. The same thing applies in the case of the electric light. You have to get over a certain inertia, and when that is done you can keep it going. But in the case of short-circuiting the electric current, for instance, which means putting a sudden strain on your machine, you must have something to get over that, otherwise your machine will be pulled up and stopped, like putting on a brake suddenly. It is generally found that there is more power required for a dynamo-electric machine than is given in the list of the makers. They generally have a way, and perhaps it is an excusable one, of saying the amount of power absorbed by the engine—that means, when it is giving its light. They take indicator diagrams, and they say what it is, and give the horse power.

Are there any obstructions put in the way of the use of electricity on ships by the maritime authorities either in America or in France?—I have not heard of them.

But the electric light is used on American and French ships?—It is used by the ocean steamers. Whether any local regulations compel them to put it out on entering port, I do not know; but I know they have carried it for some years on the ocean. It is a sort of little lighthouse or turret, about 7 or 8 feet high, with an optical apparatus on the top of it. This sends the beam forward, and they can turn it about as they like. It is used in taking in cargo or discharging it at night; they can throw the light on to the quay, and they are altogether independent of the daylight.

Mr. *James Nicholas Douglass*, the Engineer-in-Chief of the Trinity Board, was next examined as to the application of the electric light in lighthouses. In reference to the Lizard light, he said that the average annual expenses of that establishment, exclusive of the fog signal, but inclusive of interest on first cost, were £2365 for the electric light, against £1016 for oil. The combined intensity of the two oil lights at the focus of the apparatus was 528 candles. The combined mean intensity of the two electric luminaries at the focus was 8751 candles. The intensity of the full power beam, sent from the optical apparatus of each lighthouse, was about 333,000 candles, being about 211½ times the intensity of the old oil light. The cost of each description of luminary per hour for the year, of 4412 hours, is 55·3d. for the oil light, and 126·6d. for the electric light, or as 100 oil to 233 electric light. The cost of the light per candle provided, at the focus, is 0·10d. oil, and 0·14d. electric, or as 100 oil light to 140 electric light. The cost per unit of light produced at the Lizard was only one-ninth of the cost per unit of light produced at Dungeness in 1862, and the quantity of light produced at the Lizard is 13 times greater than the light produced at Dungeness. When the quantity of light produced at the Lizard and at Dungeness per pound of coke consumed was compared, the quantity of light produced at the Lizard was found to be 20 times greater than at Dungeness.

The CHAIRMAN: The general result being that, as you progress in the discovery and application of electricity to lighting, the economy becomes very great?

Witness: That is so; improvements succeed each other very rapidly, and we appear to get increased economy at each step. The trial of coal-gas luminaries, on the system of Mr. Wigham, by the Trinity House, at the Haisborough lighthouses on the coast of Norfolk, during the last seven years, affords the opportunity of obtaining the actual cost and efficiency of lighthouse luminaries produced by all the agents at present employed—viz., oil, coal gas, and electricity. Gas has been applied to seven light-houses on the coast of Ireland, and to two on the coast of England. On the diagram on the wall are shown the comparative focussing compactness, the intensity, and the cost of these luminaries. The flame of the Trinity House 6-wick oil-lamp, which is the most powerful at present in use, having an intensity of 722 candles, is found to be a more compact luminary than the gas-flames, in the ratio of 100 to 49 nearly. The immense focussing superiority of the electrical luminary over the oil-flame is found to be about 616 to 1. The two points we wish to attain are maximum of intensity and focussing power, and here we have it very graphically illustrated. [The witness described to the Committee the diagram on the wall.] Where a maximum intensity of the luminary is required, not exceeding that of the 6-wick lamp—about three times the intensity of the standard English and French first-order oil-lamp—as lately as 1873 a minimum annual cost was attained with mineral oil. For a maximum exceeding this, and not exceeding about 5000 candles (the probable limit of coal gas for a lighthouse), the minimum cost, as between gas and electricity, is with gas, in consequence of the smaller number of keepers required; the numbers being 3 in the case of gas, and 5 in the case of the electric light. But when an intensity equal to the single or combined Lizard luminaries is demanded—in the one case 8250 candles, and in the other 16,500 candles—the cost of the electric luminary, to which there appears to be no limit as regards intensity, is found to be, per unit of light, irrespective of its greater focussing value in the optical apparatus, about 13-22 and 6-22 respectively of that of coal gas at its maximum intensity, and about 13-65 and 6-65 respectively of that of mineral oil at its maximum intensity. For higher intensity, the comparison would be

still more in favour of the electric luminary, no further addition to the working staff being necessary.

By Lord LINDSAY: It appears desirable, for a complete coast light and fog signal establishment, that the highest possible intensity of the light be available for covering the sea between the two-mile sound range and the geographical light range (which averages about 17 miles), whenever this is possible. From experiments made by Professor Faraday for the Trinity House in 1836, relative to the penetrative power of light through such obstructions as fog, mist, &c., and from the experiments since made by the French lighthouse authorities and the Trinity House with oil and electric lights, I conclude that, with the atmosphere so impaired for transmission of light, the oil luminary, at its maximum intensity, would be fairly visible at the fog signal sound range of 2 miles. The electric luminary, at double the Lizard intensity, would be visible at about 4 miles. Further, on more frequent occasions, when the oil luminary would be visible at about 3¼ miles (half the geographical range), the electric light would be visible at its full range of 17 miles. Although the results to be obtained by increased intensity during impaired states of the atmosphere for the transmission of light appear feeble when compared with the power expended, yet so much can be accomplished by the electric light, in consequence of the enormous intensity available, combined with perfect focal compactness, that it will doubtless, in the cause of humanity, and in the progress of civilization and commerce, be considerably adopted.

Mr. *Thomas Stevenson*, F.R.S.E., F.G.S., M.Inst.C.E., the Engineer to the Board of Northern Lights, also gave evidence in respect to the application of electricity for lighthouse illumination. After describing the different forms of lenses in use, and the manner in which they are tested, he said the result was that as regarded power, the common plano-convex lens proved, as was expected, the most brilliant; the differential was somewhat less powerful, but the double lens was not only very much inferior in power, but the distinguishing peculiarity of the electric flash was so far lost as to assimilate it in a great degree to the oil lights. The penetrative powers of the instruments, as shown by the liquid photometer, were as follows:—The plano-convex lens, with ordinary lenticular divergence, being equal to 1·00; the differential lens, with 2½° artificial divergence in azimuth and ordinary divergence in the vertical plane, being equal to 0·90; and the double lens, with 6° of artificial divergence in the horizontal and 3° in the vertical plane, being equal to 0·75. These results seem to show that the highly distinctive flash of the electric light, when acted on by optical apparatus, is due simply to the more complete parallelism of the rays; for when it is assimilated, as regards divergence, to the oil light, the power is reduced very nearly to an equality.

Mr. SPENCER-STANHOPE: Is the result that, in your opinion, the penetration of an oil lamp is greater, in proportion to its light, than that of the electric lamp?

Witness: I am not prepared to say so, but I think it is quite possible. However, there is no doubt that by altering the divergence in azimuth and in altitude, you reduce the electric light very much in power, and assimilate it to the appearance of an oil flame.

If that is so, would it not contradict what the last witness led us to suppose—viz., that it was an advantage that the electric light was concentrated to a small point, instead of occupying that large focal width which the oil or gas lamp occupies?—That is quite my opinion, that the more condensed it is, the better for the intensity; but if that intensity is reduced by altering its divergence in altitude and azimuth, it seems to melt away, and becomes very much like the oil light; and the subdivision of the light into several different lights, I suppose, would produce the same effect.

Mr. *William Henry Preece*, examined by the CHAIRMAN.

I am Electrician to the General Post Office, and have devoted much attention to the progress of electric lighting, as well as to other branches of electricity. In the Post Office the question of the application of the electric light is a serious one from two points of view—firstly, from an economical point of view; and, secondly, from a hygienic point of view. In the Post Office we pay about £7000 a year for gas, and any means that would enable us to economize that would be of great importance. Again, in our large telegraphic galleries we have at times as many as 1000 people; and during the night, which is now really our busiest time, owing to the enormous amount of work done for the press, we vitiate 5 million cubic feet of air every hour. Of those 5 millions, 1 million are vitiated by the operators, and the other 4 millions are vitiated by the gas; so that it is a matter of very great importance to us to remove, if we possibly can, these 4 million cubic feet of vitiated air. With that view, I have examined the systems of electric lighting both in Paris and in London, and seen, as far as I have been able, everything that is to be seen. There are three criteria that I have laid down which should be attained for the illumination of such rooms as the great telegraph-rooms of the Post Office. The first criterion is that any electric light shall possess a brilliancy of at least 1000 candles. The structure of our galleries is such that six such lights would enable us to light them up as efficiently as they are lighted now. The second criterion is that the light shall be absolutely steady; for, in carrying out the work of telegraphy, reading dots and dashes on very thin strips of paper, it is essential that the eyes shall not be wearied by unsteadiness. And the third criterion is that the light shall last all night without attention, and our nights sometimes in winter extend to at least 18 hours. I have not yet found any electric lamp that combines those three conditions. The difficulties do not consist in the production of the electric currents; for, so far as that is concerned, I think in the dynamo machines of the present day we have reached almost perfection. Siemens's machine reproduces in the form of electric current 90 per cent. of the mechanical energy thrown into it; and this is as near perfection as any machine has ever attained. Gramme's machine approaches it very closely; and, therefore, as far as the production of currents is concerned, there is nothing wanting. But, as regards lamps, while the Serrin lamp, for instance, gives brilliancy, it does not give durability. Those I have seen do not last more than about four hours. The Wallace-Farmer light lasts for a week, but it does not give steadiness. The Werdermann light is remarkably steady, perhaps the steadiest there is; but its brilliancy is very small. So that whilst there are lamps that meet separately each of the three points, there is no lamp that meets them all collectively. We are, therefore, pausing until we find that the lamps are sufficiently improved to overcome the practical difficulties we experience. I have both considered and made experiments upon the subdivision of the electric current for the production of various lights, and have examined the questions theoretically from a mathematical point of view, and also experimentally. I published a paper upon the subject in the January number of the *Philosophical Magazine*. In that paper I showed that when lamps are joined up in series, the intensity of light in each lamp diminishes with the square of the number inserted; and when they are joined up in a parallel arc, the intensity of the light diminishes as the cube of the number, showing, that when you attempt to subdivide the light beyond two or three, the intensity of the light diminishes in a marvellous ratio. In my view, the electric light is only economical when one machine is used to produce a single light. Any departure from that means waste economically speaking. I do not think that the electric light is at all applicable for street lighting; and for this reason, that if you have a long street with an electric light, you may have it in the middle; but we will say, for the sake of argument, that you have it at one end, and you have that light sufficiently powerful to light efficiently the extreme end. Then at the near end you must have an enormous waste of light; because, as the light diminishes with the square of the distance, the amount at the one end of the street, to give light at the other end, must be largely in excess of the requirements at the near end. From that point of view, I am at the present moment occupied in preparing, for the *Philosophical Magazine*, another paper on the subject, in which I bring out such an extraordinary result that I am not inclined to believe it is true; but the result is this—that you can light a street of 1000 feet with 40 lamps of 15 candles power better than if you use one single electric light of 6000-candle power, showing that the ordinary gas-lamps of 15-candle power are better adapted for street lighting than a single electric light. But supposing that you have symmetrical spaces like squares, the electric light comes out right. For such a place, for instance, as the Albert Hall, for spheres, for square spaces, one single centralized light is the same in effect as a largely distributed light; and practically, for economical purposes, it is better.

The CHAIRMAN: The point that I am specially anxious to examine you about is whether there is any danger to be apprehended in regard to the telegraphic wires of the Post Office from a general use of wires to convey the electric light.

Witness: Of course, it is a point to which we at the Post Office have paid a great deal of attention; and as soon as we found that so many corporations were applying to Parliament for power to lay down wires in streets, I at once proceeded to investigate the question, to see how far the presence of wires conveying currents for lighting would interfere with our working currents. In the first place, it was necessary to find what was the relative strength or power of those different currents used; and, by very careful measurements, I find that the strength of the currents used to produce the electric light is just 3000 times as great as the strength of those used to work our telegraphic apparatus. In fact, ours are very weak currents. I took advantage of the wires that are carried through the subway along the Embankment, and I obtained permission of the Metropolitan Board of Works to make some experiments. I took into the subway lengths of wires of the various kinds we use for telegraphic purposes—gutta-percha wire, and iron wire, and pieces of submarine cable. I lashed those different wires alongside the lighting wires, and watched their effects with telephones. A telephone is perhaps one of the most delicate instruments of research that we have for showing the presence of induced currents. In fact, the telephone has shown us an extent of induced currents in our wires that we never knew of before, and, by comparing the effect of working currents on telephones in our ordinary working circuits with the effect produced on the Embankment, I was able to estimate relatively the effect on our currents of the current for lighting. We placed those wires for a distance of 50 yards along the Embankment. Those wires on the Embankment run in pairs, the top wire carrying the currents in one direction, and the lower wire carrying the currents in the reverse direction. The telephone wire was a single wire laid alongside it. At first I thought that where we had two wires close to each other, and the currents in those two wires were coming in reverse directions, the effect of the one would be to neutralize that of the other; but we had a very powerful effect, indeed, as far as 6 feet from the lighting wire. The return wire was not in contact with the other. The wires were parallel. I was not quite satisfied with the result of the trial on the Embankment, and I tried a large number of experiments; but in every case I found that the effect was very large. In order to satisfy myself that the effect was as great as the experiments showed, I then had some special wires carried, worked by an ordinary Gramme machine, connected with a Serrin lamp, and there, at a distance of 10 feet from the lighting wire, the effects upon the telephone were considerably greater than those we get in our working circuits; giving indisputable evidence that the influence of lighting currents upon our working currents is very great indeed, so great that we should not be justified in consenting to our working wires being within 6 feet of any wires carrying lighting currents.

Then your opinion is that any wires conveying illuminating currents ought to be at least 6 feet from the wires carrying on the telegraphy of the country?—Most certainly, if they are going in the same direction. Of course, that does not imply that if they cross or go near one another for a short distance, under proper regulation, they might not be allowed; but if they go for a quarter of a mile, or half a mile, they certainly ought to be kept 6 feet off the telegraph wires.

Have you seen the evidence of Mr. Cooke, who said that if you used a return wire, and connected that with the wire which was carrying the electricity in the opposition direction, you could easily compensate, and prevent any induction?—That is so; a return wire would check induction, but a return wire to every telegraphic circuit in this country is rather a serious matter.

Not for the telegraphic circuit, for the electric light circuit?—My first experiments showed that that is not so.

There is a claim that in America they have overcome the difficulties of induction by burying the wires in paraffin, and then covering them with a tin case in which mineral oil is on the outside. Do you know whether any such system of isolation is likely to prevent induced currents?—I have not heard of those particular experiments, but I should doubt it very much. I have tried every possible and conceivable arrangement of wires to cure this induction, and at the present moment I have not succeeded. Many people assert, and I thought that if we had two iron pipes lying alongside each other, the iron of the pipes would form a screen, and would prevent the induction between wire and wire. It fortunately happened that in Aldersgate Street we had three lines of pipes running side by side, and I was able to throw out of work the wires in one pipe, and to experiment with those wires, comparing them with the working wires; but the iron seemed to have no influence whatever—the induction was just as strong without the iron as with the iron; the induction in the telephone circuit was, however, very much reduced, and practically cured, by the use of a return wire.

Lord LINDSAY: You said one of your conditions of a satisfactory lamp was that it should have a light equivalent to 1000 candles. Is not that a very small value to ask for an electric light?

Witness: It is, and it was specially placed low through the fact that the lamps that existed did not comply with the other conditions, and I had hopes that if we had the other conditions complied with, there would not be much difficulty in improving the brilliancy.

As to the question of steadiness, I think that there has been within the last two years a distinct advance in the steadiness of the light, has there not?—Decidedly; and there are very strong hopes that with the experiments that are now being made in the direction of incandescence, we may ultimately succeed in getting a lamp that shall be absolutely steady. For instance, at the Royal Institution, Professor Tyndall showed a piece of iridium wire raised to incandescence, which fulfilled all the conditions: It was over 1000 candles illuminating power, it was absolutely steady, and it would last for weeks; but iridium is extremely scarce, and the light very expensive, because all machines made to procure light by incan-

descence with a closed circuit require to have very low resistance, and very high mechanical power, to work them.

Supposing that I was working with a Siemens machine, giving one light, and that it was in a large room, and it was not found convenient to work entirely from the centre, but I wished to work from two points in the room, I should practically get one-fourth of the light out of my two lights that I should get from the whole, should I not?—By theory you would; but in the case of one, two, or three lights, you get a little compensation in the increased velocity of your engine, which increases your electro-motive force, and disturbs the exact carrying out of the law; so that the sum of the two lights is not one-fourth, but it is less than what it ought to be. Supposing that you had a lamp of 2000 candles, if you had two lights you would expect to get two of 1000 candles each, and by theory you would get two lights of 1000 candles together; but by practice you would get two lights of 1500 candles together, or something like that. The practice would be in excess of the theory.

Speaking of the lighting of a street 1000 feet long, your estimate was that 40 lamps of 15 candles each, giving a total of 600 candles, would light the street better than one electric light of 6000 candles?—So my calculation comes out; but, as I said, it is so startling and so curious that I am inclined to think there must be some mistake somewhere. I have it nearly ready for the *Philosophical Magazine*, but it is so curious that I do not like to publish it unless I verify it a little further.

I rather think I agree with you, because in the one case you would have this light spread over a wider area, and you would have a more equable illumination spread over the whole area; whereas in the other case, at one end you would have a vast excess of power according to the square of the distance that you have gone?—That is so. I assume that you establish at one end of your street a light powerful enough to give the minimum amount of light necessary at the other end. Supposing it to be equivalent to 15 candles at the other end, then 15 candles will give you the same effect all over the street that you have at the extreme end; showing that the 6000 candle power at the further end is wasted.

Sir U. Kay-Shuttleworth: In addition to that, would there not be a great disadvantage from the depth of shadow all in one direction?

Witness: Certainly; that is one of the greatest disadvantages of the electric light.

Lord Lindsay: With telegraphic instruments running along underground you never use return wires, I believe?

Witness: No, never.

Could you form any estimate as to what would be the extra cost to the country of having to use return wires?—We have 112,000 miles of wire, which have been put up at a cost of 10 millions sterling. I do not suppose it would require another 10 millions, but it would cost a very large sum.

Sir David Wedderburn: You are disposed, I understand, to lay great stress on the advantages of electric lighting as against gas, because gas vitiates the atmosphere so much more than the electric light does?

Witness: Yes.

You stated that in the telegraph galleries of the General Post Office the amount of vitiation by gas was four times, if I understood you correctly, the amount due to the presence of the persons employed there?—Yes, nearly so; it is not quite four times. The exact figures are that one person vitiates 3000 cubic feet of air per hour, and one gas-burner burning 4 feet of gas per hour vitiates 9900 cubic feet of air per hour.

The Chairman: Is that the carbonic acid produced or the oxygen consumed?

Witness: It is the air vitiated by the carbonic acid produced; it is not the carbonic acid produced. Those are figures taken from Professor Parkes's book and Deschaumont's paper for the Royal Society.

Sir David Wedderburn: When you speak of the air being vitiated, you mean that it is rendered unfit for human beings to breathe?

Witness: That it is rendered injurious.

Do you find, as a matter of experience, that the persons employed in those telegraph galleries suffer from the vitiated atmosphere?—They do not suffer, for the simple reason that we take every precaution to ventilate the place as thoroughly as it can be done. The only inconvenience felt there is the extreme heat. The air, I believe, is very pure, because we have a splendid system of ventilation in the galleries.

Mr. Mitchell-Henry: Is not your requirement of a lamp that shall burn 18 hours without attention rather an excessive one?

Witness: We very often have to burn the gas for 18 hours in the winter, and we do not want to have the trouble of renewing a lamp in the middle of our telegraphic operations; we want it to be continuous. The great advantage of gas is that you merely light it, and it will remain burning for twelve months, if you want it; whereas an electric lamp will require renewal every three or four hours.

That is excessive on the other side; but if your illumination is from the ceiling, surely it would not be practically a great objection that every ten or twelve hours you would require to renew the carbons, provided there is no interruption to the light, because it is not the persons who would be attending to the telegraphy who would attend to the light?—I do not think that it would be any serious objection, and if any lamp possessed the other point, we might perhaps waive an hour or two. But in laying down a law of that kind, I thought it better to provide for all emergencies; and inasmuch as we do work 18 hours with gas, it would be as well to require the electric light to burn as long.

Do you think that it would not be possible to use a similar light for your telegraph rooms to that used in the British Museum and the Albert Hall?—It would be impossible to use for telegraphic purposes the light exhibited at the British Museum; and the light used at the Albert Hall is only a short-lived light; I think it is only a 6-hour Siemens light, and during the time that it is burning it is scarcely sufficiently steady and sufficiently intense for our purposes. It is a variable light. You do not see the variation in the Albert Hall, because they have five lights concentrated in one spot; and the variation of one lamp is compensated by the steadiness of the others; but if you distributed those five lamps over the galleries of the Post Office, the one would not help the other, and then the variation would become evident.

Was it the idea of some persons, some time ago, that the same wire could be used for lighting purposes and for telegraph purposes?—No, I never heard that idea promulgated; it is, in fact, practically impossible. The currents used for lighting purposes are so infinitely stronger than the currents used for telegraphic purposes, that if a current from a lighting machine were to enter a telegraph instrument it would burst it up.

Using a telegraph wire at one time for the electric current for purposes of communication, and at another time for lighting purposes, is quite feasible, is it not?—Yes; you could use a wire for telegraphy during the day and for lighting during the night; but the wires used for telegraphy are small-sized wires, giving great resistance, and they would at once diminish the strength of the current used for lighting purposes, so that you could get no light at all.

By the Chairman: They very likely might be fused.

Mr. Mitchell-Henry: Have there been any experiments in that direction?

Witness: There have been no experiments in that direction; but it is theoretically impossible, and, therefore, practically impossible. For lighting purposes you want thick wires; for telegraph purposes you use thin wires. The wire we use for telegraphic purposes weighs about 40 lbs. per mile; the lighting wires would be about eleven times that weight.

Sir U. Kay-Shuttleworth: You do not think it is necessary to provide for the possibility of still stronger currents being used for illuminating purposes than those that are now used, and therefore to ask for a greater distance than the 6 feet?

Witness: No; I think that the most perfect machines that we now have produce currents of about the dimensions I gave you, and there seems to be no reason why they should increase very much further. I think 6 feet would be quite enough.

I presume the thick copper wires commonly used for illuminating purposes would not be wires suitable for the delicate currents you employ for telegraphic purposes?—They would be useful, but it would be a needless waste of expense to use heavy, thick wires, where lighter and smaller wires would do.

The Chairman: The three conditions that you laid down are not, as I understand, conditions for electric lighting generally, but simply for its application to your postal purposes in the telegraph rooms?

Witness: Simply for our telegraph galleries.

Lord Lindsay: With regard to the 6-feet distance that you consider is sufficient to avoid the inductive effect in another circuit, is that with reference to the Morse instrument?—No; it is with reference to the working of our Wheatstone automatic apparatus, which is electro-magnetic. It is an instrument of great delicacy and great power that is now used to an enormous extent in this country, and it is one we are improving every day. For instance, while about this time last year we were able to transmit all our news to Ireland at the rate of only 60 words a minute, we are now doing it with ease at the rate of 150 words a minute; and with the improvements we have now in hand, we shall be able next year to transmit 200 words a minute. If these lighting wires passed near ours, it would probably bring our Irish wires down to 60 words a minute again, or, at any rate, it would reduce the speed very much. I think, by putting the wire for the lighting current about 6 feet off, you would produce about the same effect as one ordinary telegraphic wire produces upon another ordinary telegraphic wire.

I should feel almost inclined to say that 6 feet was not enough?—We should be very glad if you would give us anything beyond. All that we say is, we should be satisfied with 6 feet.

(To be continued.)

The following petition, which has been prepared by the Committee of the Gas and Water Companies Association, embodies many of the points upon which evidence on behalf of the Gas Companies will be submitted to the Select Committee on Electric Lighting, and we are asked by the Secretary of the Association (Mr. W. Livesey) to state that if the Companies who concur in these views will have petitions prepared and sent up for presentation forthwith,* the case of the Companies will be much strengthened thereby:—

In Parliament, Session 1879.

House of Commons.

Lighting by Electricity.

Petition against.

To the Honourable the Commons of the United Kingdom of Great Britain and Ireland in Parliament assembled.

The humble Petition of the Company

Sheweth:—

1. That a Committee has been appointed by your Honourable House—

> "*To consider whether it is desirable to authorise Municipal Corporations, or other Local Authorities, to adopt any schemes for lighting by electricity, and to consider how far and under what conditions, if at all, Gas or other Public Companies should be authorized to supply light by electricity.*"

2. Your Petitioners submit that it is the invariable practice of Parliament, in granting statutory powers for any purpose of public utility, to prescribe, for the protection of the public, the regulations and conditions under which such powers shall be exercised.

3. That at the present time our knowledge of the operation and effect and of the cost of applying electricity to lighting purposes is so deficient, that it is impossible to prescribe any conditions respecting the use of it for such purposes, and until some conditions can be determined it is not expedient that any Local Authorities, Gas or other Companies, should be authorized to supply light by electricity.

4. Gas Companies, when they apply for parliamentary powers, are placed under very stringent regulations for the protection of the consumers in their respective districts, which regulations are from time to time altered as Parliament thinks fit; and the following are an illustration of those now in force:—

- It is made compulsory upon a Company to furnish a supply of gas to any premises within 25 yards of their mains.
- To lay down the service-pipe and supply a meter to measure the gas supplied to such premises at their own expense.
- To maintain gas supplied at all times and under all circumstances at a certain degree of illuminating power, and free from all impurities, so that the consumer may depend upon always getting the same amount of light out of the same quantity of gas.
- To supply gas at a pressure that will enable every customer to take, at all hours and under all circumstances, any quantity, great or small, that he may require.
- The capital is limited, all new capital is required to be sold by auction, and the premiums invested in the undertaking, without dividend, and the dividends are regulated so as to rise or fall as the price is lowered or raised to the consumers.
- The accounts have to be kept in a prescribed form, printed, and deposited with Local Authorities, and the Local Authorities are empowered to appoint examiners to see that these provisions are complied with.

5. Your Petitioners submit that there is not one of these provisions that could, with our present limited knowledge of electric lighting, be applied thereto.

6. About the close of last year it was currently reported in nearly all the public journals, that a means had been discovered of conveying an electric current through mains or pipes in the streets for long distances, and that side currents could be led off therefrom to the houses on either side, in the same way as gas; and under the belief that this report might be true, numerous applications were made to your Honourable House, by Gas Companies and Local Authorities, for powers to lay down mains and pipes for these purposes.

7. It has now not only been conclusively established that there never was any just ground for these reports, but that, except as to an extremely

* Petitions can be sent to any County or District Member of Parliament, or to the Secretary of the Association (6, Victoria Street, Westminster Abbey, S.W.), who will get them presented.

limited extent, it is not possible to convey an electrical current for lighting purposes in this way, and consequently that the powers so applied for are not required, and would not be used if granted.

8. The electric light has within the last twelve months been tried as a substitute for gas in all parts of this, as well as in many other countries, and for all kinds of purposes; and that in all, or nearly all such places it has, after a trial of longer or shorter duration, been abandoned.

9. These facts are, in themselves, sufficient to prove, if any such proof is necessary, that there is no law at the present time to prevent any Company or person, except such as are incorporated for other purposes, either using the electric light themselves or supplying it to others, and consequently that no parliamentary powers whatever are required for these purposes.

10. Gas Companies, as long as they confine their operations to the making of gas, are sure of a remunerative return, and shareholders have invested their property in gas undertakings on the faith of these returns.

11. Supplying the electric light will be an entirely new and different undertaking; another and entirely different staff of workpeople will have to be employed, and for some time to come (and probably a very long time) it will be nothing else than groping in the dark, without any control over the expenditure.

12. If Gas Companies were to undertake the supply of electric light, the profits on the gas supply would inevitably be absorbed in the losses on electric light, and the price of gas be maintained at a high rate to make up for it, to the great prejudice of all gas property in the kingdom.

13. Your petitioners submit that, under such circumstances, it would be an act of injustice to the existing shareholders to apply any portion of the funds contributed by them for the making of gas to the purposes of supplying the electric light, and no such powers ought to be given to any Gas Company.

14. If, in any event, it should be deemed expedient to authorize any Local Authority supplying gas to supply the electric light, such Local Authority should be required to raise a separate capital for that purpose, [illegible] separate accounts, and be strictly prohibited from applying [illegible] to making up the losses on the electric light, without [illegible] the ratepayers.

15. Your Petitioners further submit that, if at any time hereafter the electric light should be made applicable to the general purposes to which gas is now applied, to such an extent that gas could not be supplied on the same terms as before with a profit, it would be no relief to Gas Companies merely to authorize them to supply the electric light. They would require to be relieved from all their obligations respecting gas, and be allowed to apply their capital and plant to any purposes that might be turned to a profitable account.

Your Petitioners therefore humbly pray your Honourable House not to grant any special powers for lighting by electricity, but to leave all parties desirous of using or supplying electric light to avail themselves of the powers which the law already allows, and which are amply sufficient for such purposes.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

DEPUTATION OF VESTRY DELEGATES TO THE HOME SECRETARY.

Last Friday a deputation from the Delegates appointed by the Metropolitan Vestries to inquire into the subject of the Water Supply, waited upon Mr. Cross, at the Home Office, for the purpose of presenting a memorial praying that, as the Metropolitan Board of Works were unable to cope with the difficulty, the Government would take the matter into their consideration.

Sir CHARLES RUSSELL, M.P., in introducing the deputation, said their object was to call attention to the complaints the Delegates had to make against the powers at present possessed by the Water Companies of levying their charges upon the annual rateable value of the premises supplied. They also thought that the consolidation of the eight Companies now supplying the Metropolis would conduce to economy and greater facility of supply. They admitted that the supply of water at present was amply sufficient, but it was very wastefully distributed, and they believed that by united action both the quantity and the quality might be improved.

Sir CHARLES DILKE, M.P., and Mr. FORSYTH, M.P., having spoken on the matter,

Mr. E. J. WATHERSTON presented the memorial. He said that at the first meeting held by the Delegates it was resolved that the consolidation of the Companies was a necessity, and that legislative action for this purpose ought to be taken.

Mr. J. BEAL hoped that it might be taken for granted that as Mr. Cross had agreed to receive a deputation on the subject, he meant to take it in hand.

Mr. CROSS: You must not come to any conclusion of that kind. You say that the ratepayers of the Metropolis should have water cheaper than they get it at the present moment. I should have thought you would have brought before me some figures showing how a cheaper supply of water might be given. You see the Water Companies are in possession of the field, under Act of Parliament, and you must come to terms with them. You will have to pay them a reasonable sum, and satisfy us that you could supply the water to the public at a cheaper rate than it is done at present. But you have not to-day brought figures to show that, after coming to terms with the Companies, taking everything into consideration—what you would have to pay to satisfy them—you could supply water at a cheaper rate than they do.

Sir CHARLES RUSSELL: I think, speaking from memory, it was estimated that there would be a saving of about £100,000.

Mr. WATHERSTON: It is right, Sir, that you should know that the question of figures has not been brought before the Delegates; but there exists a scheme for dealing with the whole question. Our object in coming here to-day is to ask you, Sir, to take the matter in hand. If you will kindly use your influence, there will be propounded a proper scheme on behalf of the ratepayers.

Mr. BEAL drew attention to the report of the Registrar-General on the subject, which he thought was very fairly treated.

Mr. CROSS: Upon the point raised I cannot express the slightest opinion myself. When the Metropolitan Board of Works Water-Works Purchase Bill was before the House of Commons last year, the first point taken was this: Parliament has granted certain powers to certain Companies who have laid out vast sums of money on the faith of those parliamentary powers; and Parliament has never interfered in such cases, except by an enabling Bill to carry out arrangements which have been made. Therefore when you say the capital of the Companies is so much, and you can borrow the money cheaper, of course you will have to take into consideration what terms the Companies themselves are willing to come to. That is the preliminary way of dealing with a question of this kind. I do not know whether you have approached them.

Mr. BEAL said that some time ago the Companies had been approached and terms had almost been come to.

Mr. CROSS: That is all I have to say, gentlemen.

The deputation, having thanked the right honourable gentleman for his courtesy, then withdrew.

SCHEME FOR THE AMALGAMATION OF THE SOUTH METROPOLITAN GASLIGHT AND COKE COMPANY WITH THE SURREY CONSUMERS GAS COMPANY,

UNDER THE POWERS AND PROVISIONS OF THE SOUTH METROPOLITAN GASLIGHT AND COKE COMPANY'S ACT, 1876, AND THE ACTS INCORPORATED THEREWITH.

(Submitted to the Board of Trade for approval.)

WHEREAS under the South Metropolitan Gaslight and Coke Company's Act, 1876, that Company, hereinafter called the South Metropolitan Company, whose district is on the south side of the Thames, is authorized to amalgamate its undertaking with that of any other gas company supplying gas within the Metropolis on the south side of the Thames, except the Crystal Palace District Gas Company, provided that the conditions and restrictions contained in the City of London Gas Act, 1868, under the head of "Amalgamations," shall apply to such amalgamation.

And whereas by the said conditions and restrictions it is provided that the Company shall settle a scheme for amalgamation, and submit the same for the approval of the Board of Trade, subject to such modifications as the Board may think fit to make.

And that the said scheme, when approved of by the Board, shall be submitted to the confirmation of Her Majesty in Council, and, when confirmed, have as full effect, and be as binding, as if it had been enacted by Parliament.

And whereas the South Metropolitan Company are authorized by their several special Acts to raise by share capital the sum of £750,000, and to borrow on the mortgage of their undertaking the sum of £250,000, and the Company have raised as share capital the sum of £500,000, but have not borrowed any money on mortgage, and have now the power to raise a sum of £250,000 by shares, and a further sum of the same amount by mortgage.

And whereas the South Metropolitan Company, to provide for the continually increasing consumption of gas in their district, are under the necessity of greatly enlarging their plant for manufacturing purposes, and the said Company are owners in fee simple of a large plot of land adjoining their existing works, but which land, by reason of its being far removed from the River Thames, is not well adapted for manufacturing purposes, inasmuch as every ton of coal brought thereto is subject to canal dues and haulage charges which increase the cost of making gas, but being centrally situate as respects the south of London, is well adapted for storing purposes, and large enough to provide for all the extensions likely to be required for storing purposes on the south side of the Metropolis for many years to come.

And the South Metropolitan Company are required by the said Act of 1876 to supply gas on more advantageous terms for the public than the Surrey Consumers Gas Company, hereinafter referred to as the Surrey Company, that is to say, of a higher illuminating power, greater degree of purity, and at a lower price, and are subject to all the most recent regulations affecting the supply of gas to the Metropolis from which the Surrey Company are exempt.

And whereas the undertaking of the Surrey Company is situate on the Surrey side of the Thames, and that Company is one of the Companies referred to in the South Metropolitan Gas Company's Act of 1876, and the district supplied by the Surrey Company is on the Surrey side of the Thames, adjoining the district of the South Metropolitan Company.

And whereas the Surrey Company are authorized by their special Acts to raise by share capital the sum of £250,000, and to borrow on the mortgage of their undertaking a further sum of £60,000, and they have raised the whole of their share capital and the whole of the amount authorized to be borrowed.

And whereas the Surrey Company, to provide for the continually increasing consumption of gas in their district, are under the necessity of immediately enlarging their plant for storing purposes, having, during the last winter, been placed in a position of considerable difficulty by reason of the largely increased consumption, but have no land suitable for that purpose, and cannot obtain any land convenient to their works, except at a very heavy cost, while they are owners in fee simple of a valuable site on the banks of the River Thames adjoining their present works, admirably suited in all respects for manufacturing purposes, although not available for storing purposes.

And whereas the undertakings of the said two Companies, if amalgamated and formed into one undertaking, could be carried on more economically than as two separate undertakings, and a great saving would be effected thereby in the outlay of capital, the cost of making gas, the current working expenses, and many other ways.

And whereas it would be to the benefit of the public that the undertakings of the two Companies should be amalgamated, and the provisions of the South Metropolitan Company's Act, 1876, be applied to the district of the two Companies, the following scheme for the amalgamation of the two Companies is submitted to the Board of Trade for their approval, subject to the confirmation of Her Majesty in Council.

Commencement of Operation of Scheme.

1. This scheme shall come into operation on the 1st day of July, One thousand eight hundred and seventy-nine, and all the provisions therein shall take effect on and from that date.

Amalgamated Company to be called South Metropolitan Gas Company.

2. The two Companies shall, except for the purpose of declaring a dividend for the half year immediately preceding the amalgamation, cease to exist as separate Companies, and the undertakings of the two Companies shall be united and form one undertaking, under the name and title of the South Metropolitan Gas Company, and by that name shall be one body corporate, with perpetual succession and a common seal.

Works and Properties of the Two Companies vested in the United Company.

3. All the lands, estates, property, plant, and effects, including all the gas-works, buildings, mains, pipes, meters, fittings, and conveniences connected therewith, and also all the moneys, books, rents, rates, claims, and demands whatsoever of or belonging to either of the said two Companies, shall be vested in the United Company to the same extent and for the same estate and interest as they were vested in either of the said two Companies separately.

All Rates payable to United Company.

4. All rates, rents, and charges owing to either of the two Companies shall be payable to the United Company, and shall be recoverable by such Company by the same ways and means, and subject to the same conditions as they would have been recoverable by either of the two Companies respectively but for this amalgamation.

Debts, &c., of the Two Companies to be Debts of the United Company.

5. All debts, moneys, dividends, claims, and liabilities of every description due by, or recoverable from, either of the two Companies, shall in like manner be due and recoverable from the United Company, and all cheques for such or any other purposes shall be signed by two of the Directors of the United Company, and countersigned by the Secretary.

Contracts, Agreements, &c., preserved by the United Company.

6. All debts and liabilities of every description, and all contracts, agreements, purchases, sales, conveyances, and securities incurred or entered into by either of the two Companies before the amalgamation, shall be as valid and effectual to all intents and purposes for and against the United Company as if the same had been incurred and entered into with the United Company instead of with either of the two Companies.

Actions, &c., not to Abate.

7. Nothing in the scheme shall prevent any action, suit, or other proceedings at law or in equity by or against either of the two Companies, either separately or jointly with any other company or person, commenced before and pending on the said 1st day of July, being continued, prosecuted, or enforced by or against either of the two Companies or the United Company, as the case may require.

Books to be Evidence.

8. All books, accounts, and documents, which would have been evidence in respect of any matter for or against either of the two Companies, shall be admitted as evidence in respect of the same or the like matter for or against the United Company.

Accounts of the Two Companies to be made out separately up to June 30, 1879.

9. The two Companies shall make up their accounts to the 30th of June in the usual form and mode, and such accounts, when approved of and certified by the respective Auditors, shall be taken as correct, and all dividends, debts, claims, and liabilities shown therein as due from either Company shall forthwith be paid and satisfied by the United Company, and the balances remaining after all liabilities have been discharged shall, subject to the provisions of the South Metropolitan Company's Act, 1876, be dealt with as the Directors think fit.

Application of the Reserve and Depreciation Funds.

10. The reserve-fund and the depreciation-fund of the Surrey Company shall be added to the reserve-fund of the South Metropolitan Company, and form the reserve-fund of the United Company.

Registers of Amalgamating Companies to subsist until replaced.

11. All registers of shares, mortgages, bonds and debenture stock of either of the two Companies, and all registers of transfers thereof respectively, and all Shareholders address-books and all certificates of shares or stock of and in either of the two Companies which are valid and subsisting at the commencement of this scheme, shall continue to be valid and subsisting and shall have the same operation and effect after as before such commencement, until new or altered registers, books, and certificates respectively are substituted in their stead in pursuance of this scheme.

Resolutions, &c., continued.

12. All resolutions, orders, and proceedings of general meetings and Board of Directors, which at the time of this amalgamation are binding on either of the two Companies, or their respective Shareholders, Directors, Officers, or Servants, or any of them, shall, so far as they are applicable, continue in full force, and be binding on the United Company, and their Shareholders, Directors, and Servants accordingly, until the same be varied, altered, or repealed by order of a general meeting or a Board of Directors of the United Company, as the case may require.

General saving of Rights and Claims.

13. Everything done, suffered, and confirmed by or relating to either of the two Companies before the commencement of this scheme, shall be as valid as if this scheme had not been confirmed; and the commencement of this scheme shall, except only as is in this scheme otherwise expressly provided, be subject and without prejudice to everything so done, suffered, and confirmed respectively, and to all rights, liabilities, claims, and demands, both present and future, which would be incident to, and consequent on any and every thing so done, suffered, and confirmed respectively; and with respect to all such things so done, suffered, and confirmed respectively, and to all such rights, liabilities, claims, and demands, the United Company shall, to all intents and purposes, represent both of the amalgamating Companies.

CONSTITUTION AND REGULATION OF UNITED COMPANY.

Provisions of existing Acts continued.

14. The Acts relating to or affecting the South Metropolitan Company and the Surrey Company in force at the date of the commencement of this scheme, shall, except so far as the same are varied by, or inconsistent with this scheme, remain in full force; and all rights and powers of such Acts, or any of them, conferred on and vested in either of the two Companies in relation to the undertaking of such Company, may be enjoyed and exercised by the United Company.

Half-Yearly Meetings.

15. The half-yearly general meetings of the United Company shall be held either in the months of March and September or April and October, as the Directors may deem expedient.

Directors of the United Company.

16. The Directors of the two Companies shall be the first Directors of the United Company, but as soon as may be after the confirming of this scheme, they shall settle among themselves, by ballot or otherwise, for a certain number to retire, so that the number shall not be more than *nine*, nor less than *six*.

Remuneration to the Directors.

17. The fees payable to Directors continuing in office shall, subject to the provisions of the South Metropolitan Companies Special Act, 1842, be £3000 per annum, and the amount of compensation payable to any Director who may be required under the preceding provision to vacate his office shall be seven years purchase of the fees receivable by him before the amalgamation.

Compensation to retiring Directors to be paid by United Company.

18. The amount of such retiring allowance shall be charged upon the general funds of the United Company, and shall be carried to a suspense account, which shall be liquidated by equal annual instalments during the next five years.

Qualification of Directors.

19. The qualification of a Director shall be the possession of paid-up shares or stocks of the nominal value of £2000.

Auditors.

20. The Auditors of the two amalgamating Companies in office at the date of the commencement of this scheme, shall continue in office until the first general meeting at which the Auditors are appointed held by the United Company. At that meeting the Shareholders of the United Company shall elect two Auditors, and thenceforth the number shall be two, and any person being an Auditor of either of the two Companies at the time of the amalgamation, who is not elected an Auditor for the United Company at the said general meeting, shall be entitled to a gratuity not exceeding two years salary.

Qualification of Auditors.

21. The qualification of an Auditor shall be the possession of paid-up shares or stock of the nominal value of £1000.

Officers, &c., of the Two Companies to be Officers, &c., of United Company.

22. All officers and servants in the employment of either of the two Companies at the time of the amalgamation, shall hold their respective offices and employment, and be deemed to be officers of, or persons employed by the United Company, until removed in pursuance of this scheme, and they and their respective sureties (if any) shall for the purpose of any liability incurred by them respectively, in respect of such employment and suretyship, be deemed respectively to have been employed by, and become bound to the United Company, in the place of either of the said two Companies.

Salaried Officers to receive Annuity for Life.

23. Subject to the provisions hereinafter contained, every salaried officer of either of the two Companies who at the time of the amalgamation has been employed by either of such Companies for five years or more, and whose office and employment is abolished, or whose services are dispensed with in consequence of this amalgamation, shall be paid by the United Company during his life an annuity, payable quarterly, equal, if he had been in the service of either of the amalgamating Companies 20 years or more, to two-thirds of the annual emolument derived by him from his office, at the date of the commencement of this scheme, and with respect to any such person who has been in such service less than 20 years, the said annuity shall be diminished at the rate of 1-20th part for every year less than 20 years, during which he has been in such service, any annuity payable under this section, or any retiring allowance or pension granted to any officer of either of the two Companies previous to the amalgamation may, with consent of the United Company and of the annuitant, be compounded for by payment of the principal sum for which an annuity of the amount would be purchaseable under the table regulating the granting of annuities by the Postmaster-General.

Salaried Officers not entitled to Annuity may be Compensated.

24. The United Company may pay to any salaried officer whose office is abolished, or whose services are dispensed with in consequence of this Act, and who is not qualified to receive an annuity, under the last preceding section, a sum of money not exceeding one year's emolument, by way of compensation for the loss of such office.

Annuity may be increased by Sanction of Board of Trade.

25. The annuity, or sum of money payable under either of the last two preceding sections, may, in the case of an officer who has rendered special services to either of the two Companies, with the special sanction of the Board of Trade, be increased to a larger amount than is authorized in those sections respectively.

Gratuity to Weekly Servants.

26. A gratuity not exceeding three months pay may be given to any weekly servant whose services may be dispensed with in consequence of this Act.

Decision as to Offices abolished.

27. The decision of the Board of Directors of the United Company as to whether an office or employment has been abolished, or whether any services have been dispensed with in consequence of this amalgamation, shall be final and without appeal in every case.

Capital.

28. The authorized capital of the United Company shall be the authorized capital of the two Companies respectively at the date of the amalgamation, and which are as follows:—

—	Authorized.	Called Up.	To be Called Up.
South Metropolitan Company.	£ s. d.	£ s. d.	£ s. d.
5 & 6 Vict., c. 79, 1842 . .	250,000 0 0	250,000 0 0	—
32 & 33 Vict., c. 130, 1869 .	250,000 0 0	250,000 0 0	—
39 & 40 Vict., c. 229, 1876 .	250,000 0 0	—	250,000 0 0
	750,000 0 0	500,000 0 0	250,000 0 0
Surrey Company.			
17 & 18 Vict., c. 94, 1854 . .	150,000 0 0	150,000 0 0	—
26 Vict., c. 37, 1863	100,000 0 0	100,000 0 0	—
	1,000,000 0 0	750,000 0 0	250,000 0 0

Designation of Shares in United Company.

29. The capital of the United Company, whether consisting of shares or stock, or part one and part the other, shall be classified as follows, viz.:—The existing capital of the South Metropolitan Company shall be designated "A" capital. The existing capital of the Surrey Company shall be designated "B" capital, and all new capital created by the United Company shall be designated "C" capital.

Dividend on Different Classes of Shares.

30. All three classes of capital, "A," "B," and "C," shall participate equally in the profits up to 11 per cent.; but in the event at any time of a larger dividend than 11 per cent. being payable on all three classes, the proportion of such larger dividend that but for this agreement would be payable to the holders of "B" capital, shall be paid to the holders of "A" capital, in addition to their own proportion of such larger dividend as aforesaid.

United Company to issue New Certificates.

31. The United Company shall, when required, as soon as may be after the confirmation of this scheme, call in all certificates whether for shares or stock in either of the two Companies respectively, and issue in lieu thereof, and at their own expense, new certificates specifying the class to which they belong for shares or stock, as may hereafter be determined, in the name of the United Company.

Votes of Shareholders.

32. Every Shareholder in the United Company shall be entitled to vote according to the following scale, that is to say:—One vote for every £100 of paid-up stock or share capital, fractions of £100 being disregarded. No Shareholder shall be entitled to vote at any meeting unless he shall have paid all calls then due upon the shares held by him.

Borrowing Powers.

33. The amount authorized to be borrowed by the United Company shall be the aggregate of the amounts authorized to be borrowed by the

special Acts of the two Companies respectively, and which, at the date of this amalgamation, are as follows, viz.:—

—	Authorized.	Borrowed.	To be Borrowed.
South Metropolitan Company.	£ s. d.	£ s. d.	£ s. d.
32 & 33 Vict., c. 150, 1869. .	62,500 0 0	—	—
39 & 40 Vict., c. 229, 1876. .	187,500 0 0	—	—
	250,000 0 0	—	250,000 0 0
Surrey Company.			
17 & 18 Vict., c. 94, 1854 . .	35,000 0 0	—	—
26 Vict., c. 37, 1863	25,000 0 0	60,000 0 0	—
	310,000 0 0	60,000 0 0	250,000 0 0

United Company may exercise Powers of raising Capital.

34. The United Company may exercise in its own name the powers possessed by the South Metropolitan Company at the date of the amalgamation, of raising capital by shares, or by borrowing in the same manner and to the same extent as the South Metropolitan Company might have done before the amalgamation.

Existing Mortgages to be charged on United Company.

35. The mortgage debt of £60,000 on the undertaking of the Surrey Company shall be a charge upon the undertaking of the United Company as if such mortgage had been granted by the United Company instead of by the Surrey Company.

District of the United Company.

36. The district to be supplied by the United Company shall be the districts now supplied by the two Companies respectively, as defined by the Metropolis Gas Act, 1860, and the provisions of the South Metropolitan Company's Act, 1876, respecting the illuminating power and purity of the gas to be supplied and the price to be charged for the same, and as to the appointment of Referees and Examiners to test the illuminating power and purity, and also the provisions for the regulation of the dividend to be paid to the Shareholders by the price charged to the consumer, and the appointment of a public auditor by the Board of Trade to examine the accounts and other matters, shall apply to the United Company and the whole of the district supplied by them, and the bye-laws, restrictions, orders, and proceedings of the South Metropolitan Company shall continue in force with, and be applicable to the United Company.

Provided that the penalties imposed by sections 51 and 52 of the South Metropolitan Company's Act, 1876, respecting deficiencies in the illuminating power or purity of the gas supplied in the district of that Company, shall not apply to the gas supplied in the district of the Surrey Company until twelve months after the commencement of the amalgamation.

Provided also that if the price of three shillings and ninepence, now charged in the district supplied by the Surrey Company, is reduced to three shillings and twopence, and the price of three shillings, now charged in the district supplied by the South Metropolitan Company, is continued at that or any lower rate, the United Company may, for a period of twelve months after the commencement of the amalgamation, pay dividends on the capital of each Company respectively, at the rate prescribed by section 21 of the South Metropolitan Company's Act, 1876, and according to the price charged in the district of each Company respectively, subject, nevertheless, to clause 30 of this scheme.

United Company may Sell and Dispose of Lands.

37. The United Company may from time to time sell and dispose of any of their lands and plant which may not be required for the purposes of their undertaking, and a resolution of a general meeting that any of the said lands or plant are not so required shall be sufficient evidence thereof. The proceeds of any and every such sale shall be applied to the general purposes of capital in the United Company.

Interpretation of Scheme.

38. If any question arises as to the interpretation of this scheme, whether in connection with the said Acts relating to or affecting the two Companies or otherwise, the same may be referred to the Board of Trade for their decision, and the decision of the Board of Trade thereon shall be final.

United Company to pay Costs of Amalgamation.

39. The United Company shall pay all the expenses of and incidental to the closing of the accounts of the two Companies respectively, and of and incidental to their amalgamation.

PURCHASE OF THE LANCASTER GAS COMPANY'S WORKS BY THE CORPORATION.

On Tuesday, the 29th ult., a Special Meeting of the Lancaster Town Council, as the Urban Sanitary Authority, in Committee, was held for the purpose of taking into consideration a recommendation of the Parliamentary Committee, in reference to the purchase of the gas-works. From the minutes of the Committee, dated April 22, it appeared that it was resolved—"That, subject to the approval of the Authority, the terms of the Gas Company for the purchase of the works be accepted;" and they presented the following report:—

The Parliamentary Committee, which was entrusted by the Town Council with all necessary powers for the protection of the interests of the ratepayers, as affected by the Bill promoted by the Lancaster Gas Company, beg to report as follows:—

The Committee have devoted a considerable time to the investigation of the various questions arising out of the special duty with which they were charged. They have been assisted by the professional advice of Mr. G. W. Stevenson, C.E., an eminent Gas Engineer, and of Mr. Mansergh, C.E., the Engineer to the Corporation. The result of the labours of the Committee, which has only been arrived at after mature consideration and anxious deliberation, is embodied in the resolution which recommends the Council to purchase the undertaking of the Gas Company. Negotiations were opened with the Directors of the Gas Company, who expressed their willingness to receive a proposal. An offer was then made by your Committee, which was declined by the Directors as "altogether inadequate." Eventually a statement of the terms the Company were willing to accept was communicated in the following manner from the Manager of the Company:—

"*Gas-Works, Lancaster, April* 18, 1879.

"R. Bond, Esq., Clerk to Urban Sanitary Authority.

"Dear Sir,—My Directors have given the most earnest consideration to that part of your letter of the 14th inst., asking my Company to name the lowest price they will take for the gas-works. My Directors desire to meet the question in the spirit they believe it has been considered by your Board, and I am instructed to reply that they are prepared to recommend their Shareholders to accept £80,000 in annuities or cash, as may be agreed, your Board taking upon themselves the statutory debt of the Company, adopting any existing contracts and engagements, and take by valuation on the 30th of June next the then working stock of the Company, the Company to pay their liabilities, and retain for their own use their assets and credit on the 30th of June.

"You will please bear in mind that these terms and proposals are made subject to the concluding paragraph in my letter of the 10th inst., and for the reasons given in that letter I beg to ask for your very early reply.—Yours truly, W. Fleming."

An interview subsequently took place with respect to these terms, and your Committee became satisfied that the very lowest price had been named, and that no abatement could possibly be effected. The Committee were therefore forced to the conclusion that they must adopt these terms or abandon any chance of securing the transfer of the works to the town.

Believing that such a transfer would be advantageous in many respects, and that, at the price quoted, there was a reasonable prospect of a surplus profit, the Committee have signified their acceptance of the terms, subject to the approval of the Town Council.

The reports of the Engineers, with an abstract of accounts of the Gas Company for the last eleven years, have been printed and circulated amongst the members of the Council, as the data upon which to form their own conclusions as to the propriety of the arrangement.

The Committee would also recommend, if the Council should think fit to confirm the bargain with the Gas Company, that the transfer of the undertaking should, if practicable, be made to the Corporation rather than to the Sanitary Authority.

Mr. Milner, Chairman of the Parliamentary Committee, moved, and Mr. Cleminson, Chairman of the Lighting Committee, seconded—"That the minutes of the Parliamentary Committee of April 22, 1879, and the report of the Committee, now read, be adopted and confirmed."

An amendment was moved by Mr. Blades, and seconded by Mr. Hatch—"That the Authority do not purchase the gas-works at the price asked by the Company."

The amendment, on being put, was lost by 3 votes to 10, and the motion was therefore declared to be adopted.

On Monday, the 5th inst., a special meeting of the Corporation was held for the purpose of confirming the preliminary agreement for the purchase of the Lancaster Gas Company's works by the Corporation, as decided upon the previous week. A motion affirming the purchase having been proposed by Mr. Milner, and seconded by Mr. Cleminson, Alderman Welch proposed as an amendment that the offer of the works at £80,000 be rejected, as he considered the sum of £75,000 would be ample. Upon a division, 5 voted for the amendment and 10 for the original motion, which was declared carried. The purchase will now be completed as soon as possible. Aldermen Storey and Preston expressed their opinion that the town would be decidedly benefited by the Corporation taking the gas-works into their own hands.

The following is the report of Mr. G. W. Stevenson upon the proposed purchase:—

38, *Parliament Street, Westminster, April* 25, 1879.

To the Parliamentary Committee of the Lancaster Corporation.

Gentlemen,—I have now the honour to report to you upon the state and condition of the Lancaster Gas-Works and undertaking, and upon the terms which I have been given to understand have been arranged between the Company and Corporation, for the transfer of the undertaking from the one to the other.

On the 26th of February last, and the day following, I was in Lancaster, and, together with Mr. Mansergh, made a careful examination of the gas-works.

The retort power is exactly 60 per cent. in excess of the present requirements. The condensing, scrubbing, and purifying powers are in the same proportion. The storeage capacity is decidedly under present requirements, being only equal to 237,000 feet, while the largest daily make in the winter of 1878 was 366,000 feet; and there requires a duplicate engine for exhausting the gas. Altogether an expenditure of about £12,000 to £15,000 is required to bring up the capabilities of the works as a whole to fully 50 per cent. more than the requirements of last winter.

The works have been well designed and substantially constructed, with all modern improvements, and are maintained in a state of perfect order and efficiency, reflecting the highest credit upon Mr. Fleming, the Engineer and Manager. There are very few works in the kingdom more complete and perfect than the Lancaster Gas-Works.

The quantity of gas made in 1878 was 50,172,000 feet; the quantity sold was 46,879,000 feet. The quantity, therefore, unaccounted for, commonly called leakage, was about 6½ per cent.—a remarkably low percentage of loss, indicating that the pipes for distribution are of ample size and in good condition.

The growth of the business during the last few years has been at the rate of 7 per cent. in the compound ratio; which means, in other words, that the business doubles itself in ten years.

The Company employ in their business a capital of £30,000 in shares entitled to 10 per cent. dividend, and £7000 in loans raised under their statutable powers.

I do not know the rate of interest which the Company pay upon their loan capital—probably a trifle over 4 per cent.; but with the larger and better security of the rates, in addition to the profits of the gas undertaking, there is no doubt that if the undertaking were in the hands of the Corporation, the necessary capital could be raised at 4 per cent. interest.

Last year, with a selling price of gas considerably below the maximum price which Parliament has authorized the Company to charge, the profits of the undertaking, after striking out Directors fees and adjusting the excess in expenditure in that year upon retorts, amounted to £5029, a sum which was really £1500 in excess of the sum required to pay maximum dividends and interest upon loan capital; thus sufficiently proving that the undertaking has been well managed, and is in an exceedingly prosperous condition.

The Company are applying to Parliament this session for power to raise, by shares and borrowing, further capital to the extent of £83,000, which would probably carry them on for another 20 years, and enable them to treble or quadruple their business. Against this Bill you have petitioned; and, among other things, have alleged that it is expedient that the undertaking of the Company should become the property of the Corporation.

Upon this, negotiations for a transfer have taken place, and I am informed by the Chairman of your Committee that terms have been arranged by which the Corporation are to pay £80,000 in cash, or perpetual annuities upon that sum, at 4 per cent., and that you are also to assume the bond debt of the Company, amounting to £7000, and pay for the stock-in-trade on the premises on the 30th of June next.

These terms, while fair to the Proprietors, are, in my opinion, very favourable, under the circumstances, to the ratepayers.

The position of affairs on the transfer will be as follows, taking the figures of 1878 as a basis:—

Net profit		£5029
Deduct 4 per cent. on £80,000 purchase of dividends	£3200	
Deduct 4 per cent. on £7000 loan capital	280	
Deduct 4 per cent. on £3000, the possible amount of stock-in-trade, and all contingencies, together with preliminary expenses	120	
		3600
Surplus profit		£1429
But there needs to be expended, say, at the outside, £15,000 for additional storeage; and for duplicating the engine power		£1429
And 4 per cent. on £15,000		600
Still a surplus of		£829

The longest term that has been allowed to any local authority for the repayment of loans employed in the purchase of a gas undertaking is 60 years; but the more common period is 50 years. It is usual also for Parliament to allow five years from the period of contracting the loan before requiring that the sinking-fund for its extinguishment shall be commenced.

For the purpose of this calculation, I shall assume that the Corporation will be required to repay borrowed moneys in 60 years, and that the sinking-fund will not commence until the expiration of five years from the contraction of the loan.

As before stated, the business of the Company has increased hitherto at the rate of 7 per cent. per annum in the compound ratio. It is stated that business generally in Lancaster is not likely to be so brisk in the immediate future as it has been in the immediate past, and I will therefore assume that 5 per cent. in the compound ratio will be the increase in the gas business during the next five years. If that estimate be verified by results, the profit in 1883 [the profit of £5029 was the profit of 1878] will be £6417

And the obligations of the Corporation will be (including the further expenditure of £15,000 on capital account) 4 per cent. interest on £105,000, or £4200

And the sinking-fund to extinguish the loan at 3 per cent. compound interest in 55 years 766

4966

Surplus profit £1451

It is thus shown that immediately on entering upon the concern the Corporation will, if they charge the same price for gas that is now being charged by the Company, make a profit of £1429 per annum; and that at the expiration of five years after paying interest upon the fully expended capital, and setting aside a sinking-fund for its redemption, there will be a profit of £1451.

I have not the slightest doubt that these figures will be more than reached in actual results, and that in the course of years the undertaking will be found to be very profitable to the ratepayers, and the management of if by the Corporation very advantageous to the consumers of gas.

There are many substantial reasons why gas undertakings should be in the hands of local authorities.

In the first place, the transfer abolishes a monopoly carried on in the interest of a few, and hands it over to the benefit of the community.

Secondly, it is desirable that the management and control of the streets should not be interfered with by any except those in whom the control is legally vested. It is no uncommon occurrence that after a street has been newly paved or macadamized, a gas company should rip it up from end to end, 3 feet deep and as many wide, for the purpose of taking up and relaying a pipe which, if the undertaking had been in the hands of the local authority, would have been done before the street was re-made. A street so interfered with can never be made entirely good like a new street, but will always show traces of the interference, and be, in fact, more or less damaged for use.

Thirdly, it is a great advantage, both to ratepayers and consumers of gas, that capital for the purpose of carrying on an undertaking of this kind should be raised at the lowest possible rate of interest, which is now about 4 per cent., instead of at the usual rate of 7 or 10 per cent. which a company of proprietors are authorized to divide among themselves as profits, and this is accomplished when a gas undertaking becomes the property of the local authority. The consumers of gas benefit by a possible reduction of the price, because the same amount of profit can be obtained with a less price of gas per 1000 feet, and the ratepayers benefit by having the profits applied in reduction of the rates, or in effecting public improvements.

Fourthly, when a gas undertaking is the property of the local authority, it is managed by a committee selected from the representatives of the consumers, who are, in almost every case, ratepayers, and if the management be not satisfactory, it can be displaced by those who created it until it does become satisfactory to those whose property the undertaking really is. The directors of a gas company are not accessible to influences of this direct character, and sometimes are not capable of being influenced in any way whatever.

Fifthly, there is no inducement on the part of a local authority to expend more money in the undertaking than is required for the purposes of the business; and, on the other hand, there is no inducement to starve the concern for want of sufficient capital.

Sixthly, in nearly every instance in which gas undertakings have been transferred from companies to local authorities, there has been a very decided impulse given to the consumption of gas. I am not prepared to explain how this has come about. It may be that people generally have consumed more gas, and others have taken it for the first time from a knowledge that the profits will come back to them in one form or another. One town is within my knowledge in which not one-half of the houses had a supply of gas so long as the works remained in the hands of the Company; and within five years after the works passed into the hands of the Corporation there were not so many as three houses in each hundred without a supply of gas. This is no doubt an extreme case, but the fact is notorious that by the transference of the gas-works to the ratepayers the consumption of gas is always greatly increased.

During the last few years, 93 gas undertakings have passed out of the hands of companies into the possession of local authorities, and in no single instance within my knowledge has the undertaking been otherwise than profitable to the authority possessing it. In no case has an authority been under the necessity of levying a rate in order to enable it to pay its obligations. There has been always a surplus of profit, and frequently a very considerable surplus.

With regard to the security of the profits from the purchase which you have just arranged, it is perhaps, after what I have said, scarcely necessary to mention the progressive character of the business, and the certainty that with the increase of business the Corporation will be able to supply gas at a lower price with a larger profit.

The electric scare is about over. We shall probably hear of it again ten or twenty years hence. The effect of that scare has been to show people that our streets and public buildings may be, and ought to be, better lighted than they have been hitherto; and the result will, no doubt, be a great improvement in the burners by which gas is consumed, and an increase in the quantity of gas used.

My own opinion is that the perfection of lighting by coal gas has not yet been reached, and that, for many years to come, improvements will be made which will render coal gas, and the means by which it is consumed, a more ready and convenient servant than it now is.

I am, gentlemen, your obedient and faithful servant,

GEORGE WILSON STEVENSON, Engineer.

Mr. J. Mansergh's reports are as follow:—

Westminster, March 6, 1879.

Sir,—In accordance with a previous appointment, Mr. Stevenson and I visited the gas-works on the 26th ult., and were received most courteously by Mr. Fleming, who showed us all over the establishment, and answered our inquiries without the slightest reserve. All the buildings and apparatus are in good condition and repair, and the whole place is conveniently arranged, and worked in the most orderly and systematic manner. The retort-house contains 120 retorts, 8 ft. 2 in. long, and 15 in. diameter, capable of producing at least 30 per cent. more than the present greatest daily delivery of gas. Judging from the increase in the consumption of the last few years, it is quite clear that additions will shortly have to be made to the works, principally probably in respect of condensing apparatus and gasholders. More room also is required for the storage of coke and for carrying on the processes, and storing the products of the treatment of the tar and ammoniacal liquor.

The Company are, therefore, justified in applying to Parliament for an extension of their capital powers. The works shown upon the parliamentary plans are sidings in connection with the contemplated Glasson Dock Railway, and would undoubtedly materially increase the convenience and lessen the expense of bringing in coal, cannel, lime, &c., and removing the residuals. It is probably not material to consider the outlay that may be incurred upon these sidings, because it is pretty clear that if constructed in a fairly economical manner their cost will be more than covered by the consequent saving in working expenses. So far as I am able to judge, I should think the judicious expenditure of £12,000 would put the works into a position to meet the demands of the district for a good many years to come.

My opinion is very decided that you ought to endeavour by all legitimate means to effect the transfer of the undertaking from the Company to the Corporation. Fifty years ago, the then Shareholders invested their money in an undertaking of a somewhat speculative character, by which, no doubt, the town benefited, and for 30 years, I believe, they did not receive an average of more than 5 per cent. on their investment. In 1856 they were incorporated under an Act of Parliament, and obtained a regulated monopoly for the supply of gas, with the power to divide 10 per cent.; but it was not until 16 years after that this dividend was earned. They have, however, since paid up deficiencies of dividend as far back as 1868, and, according to Mr. Fleming, they have also received an equivalent for the arrears of preceding years.

If the Company obtain further capital powers in the present session, it will be with the limitation of a 7 per cent. dividend, and also with the obligation to offer the shares by auction to the public. Although these restrictions would undoubtedly render the gas property of the future less valuable to the Company than it has been in the past, the ratepayers of the town will, in my opinion, derive substantial benefit from becoming possessors of the undertaking. I am sure that economy as well as efficiency would result from such a change.

If the Company are allowed to acquire further capital powers, without the terms of purchase being agreed, the selling price of the undertaking will immediately be enhanced in proportion to the amount of capital authorized.

For the sake of getting the matter into the practical shape of figures, I will assume that the acquiring of the whole undertaking, including all compensations, preliminary expenses, and stock-in-trade, costs the Corporation the sum of £90,000. I will also assume that £12,000 will have to be spent in the extension of the works, within two years from the time of the transfer. The £90,000 purchase-money would include the statutory debt of the Company, amounting to £7000, upon which, I believe, the interest payable, under present arrangements, is £304 10s. per annum. I will, however, in order to simplify the figures, treat the £90,000 as a whole, and will calculate on it being borrowed at 4½ per cent., which will, I suppose, under the circumstances, be the outside price which will have to be paid. Then a sinking-fund will have to be set aside for the extinguishment of the debt in a given time, and I will assume that the same term is allowed by Parliament as was granted in the case of the Water Act of 1876—viz., 65 years. This I will estimate can be invested at 3 per cent. compound interest, and I will suppose that the first instalment will be chargeable in June, 1883, a year after the £12,000 have been spent in the extension of the works. I find from the accounts of the Company that their gross income has increased since the year 1870 at the rate of a little over 7 per cent. per annum, and that the increase in expenses has been somewhat less than this rate.

Now, in 1878, the net profit on the working was at least £4800, and if it is assumed (in order to be quite within the mark) that the annual increase in the future will be only 3 per cent., and not 7, the net profit in 1880 will be £5092. From a table given, it appears that if the transfer of the works takes place in June this year on the terms assumed, and the charges for gas are maintained as at present, the Corporation will have realized a clear profit of £1267 at the end of a year's working; that in June, 1883, after the charges consequent upon the expenditure of £12,000 new capital have become due, and the investment of the sinking-fund has commenced, the net annual profit will still be £707, and in 1885, £1044; that this profit will continue to increase in amount year by year until new capital expenditure is required.

It would be for the Corporation to determine whether they would at once reduce the price of gas, and by this means probably increase the number of consumers, or let the profits go to a reduction of the general rates. In my opinion, the fairest course would be to lower the price of gas as soon as they saw their way to this being done with safety.

My own opinion is that even if the town does not continue to grow as in the past few years, the consumption of gas will increase in a greater ratio than it has hitherto done. Gas-fires, gas-cooking apparatus, and gas-engines are coming very much into fashion, and there is a cry, both indoors and out, for "more light." I have read very carefully the opinion and reports of the many able men who have written on electric lighting, and I have made myself acquainted generally with the subject, and my opinion is that it will not supersede the use of gas, excepting for very special purposes in very few places.

I cannot close these remarks without expressing my conviction that the time has arrived for the gas-works to become the property of the town. I believe the Company are ready to sell, and that the leading men in it are unlikely to hold out for a fancy price. I believe there is a future for gas which is not adequately assessed by my assumption of a 3 per cent. increase, and I believe that, owing to the agitation on the electric light question, the manufacture of gas will be cheapened, its quality will be improved, and its use extended.

Westminster, April 25, 1879.

The foregoing is, with a few verbal alterations, the report I presented to you on the 6th of March. I have since learned that your consideration of the matter, and your negotiations with the Directors of the Gas Company, have resulted in your deciding to advise the Council to purchase the gas undertaking for £87,000, and to take over the stock-in-trade at a valuation. Practically, therefore, the transfer is proposed to be effected on the terms I had estimated. I am of opinion that these terms are fair between the parties, and such as the Council and the ratepayers may confidently be advised to approve.

I have had an opportunity, this morning, of reading Mr. Stevenson's report to you on the subject of the contemplated transfer, and am glad to find that he takes even a more favourable view than I have done of the prospects of the concern. Whilst spending £15,000 in extensions, he esti-

mates that at the end of five years the surplus profits of the year's working, after paying interest on capital, and setting aside the proper amount for sinking-fund, will be £1451. Mr. Stevenson has had a very large experience in these matters, and his opinion is more valuable than my own, and any wavering members of the Council should take his figures and not mine into account in deciding how they shall vote upon the question.

I have just come from the Committee who are investigating the subject of electric lighting, with Dr. Lyon Playfair as Chairman, and have heard the evidence of Professor Tyndall. In answer to the last question put to him he stated that he felt satisfied that this light was not going to result in the abolition of gas, but that gas would in the future be used in a great many ways that were not now contemplated.—I am, &c.,

(Signed) JAMES MANSERGH.

WEST OF SCOTLAND GAS MANAGERS ASSOCIATION.

The Seventh Annual Meeting of this Association was held at Coatbridge, on Friday, the 25th ult.—Mr. SAMUEL STEWART, Engineer of the Corporation Gas-Works, Greenock, President of the Association, in the chair. There was a much larger attendance of members than at any previous meeting.

MR. R. S. CARLOW (Port Glasgow), the Secretary of the Association, read the minutes of the various Committee meetings held since the last meeting of the Association in Kilmarnock, which were approved.

FINANCIAL POSITION OF THE ASSOCIATION.

The SECRETARY then submitted a statement of the financial position of the Association, and the Auditors report, from which it appeared that the Benevolent-fund amounted to upwards of £100.

The PRESIDENT said from the statement submitted by the Secretary it would be seen that the financial position of the Benevolent-fund was highly satisfactory.

ARREARS OF SUBSCRIPTIONS.

The SECRETARY said there was rather over £33 of arrears. If members would pay up their subscriptions promptly, the Association would be in a much better position than at present.

Mr. NIVEN (Dunoon) asked whether that included the amount to be paid that day, or only related to what was due.

The SECRETARY said it was in part what was due that day.

The PRESIDENT said it was useless to burden the list of members with the names of those who ceased to take an interest in the Association, and, therefore, their names had been struck off.

Mr. MITCHELL (Coatbridge) said most of those present would probably remember that, at the last annual meeting, he drew attention to the fact that many of the members subscriptions were in arrear, and that a considerable amount of the Secretary's time was occupied in attending to these details, while his other duties were very onerous. In the interest alike of the Secretary and of the Association, he would, therefore, move—"That a committee be appointed with full power to draw up a list of those in arrears, and that the committee should have full power to strike off from the roll of membership the names of those parties who have been two years in arrear with their subscriptions."

Mr. RENFREW (Langbank) seconded the motion, and it was agreed to.

ELECTION OF OFFICE-BEARERS.

The following gentlemen were elected as office-bearers of the Association for the ensuing year:—

President—Mr. Robert Mitchell, Coatbridge.
Vice-President—Mr. R. S. Carlow, Port Glasgow.
Secretary—Mr. S. Dalziel, Kilmarnock.
Treasurer—Mr. W. Smith, Helensburgh.
Auditors—Mr. S. Black, Alexandria, and Mr. L. Monk, Lanark.
Committee—Messrs. S. Stewart, W. Young, J. M'Gilchrist, D. Jeffray, W. Fairweather, J. Renfrew, J. Fullerton, J. Adam, and J. Johnston.

RULES OF THE ASSOCIATION.

Mr. M'GILCHRIST (Dumbarton) gave notice that, at the next annual meeting, he would move that a committee be appointed to revise the rules, and at the same time to see that an arrangement is made whereby three of the oldest members of the Committee should retire annually, and that the retiring members should be balloted for in the same way as is done at the meeting of the North British Association of Gas Managers.

The PRESIDENT said he thought it would be well if members would look over the rules, and see whether there were any alterations they could suggest.

ADMISSION OF NEW MEMBERS.

The following gentlemen were elected members of the Association:—

Adamson, James L. . .	Airdrie.
Fisher, David	Gas Manager, Blantyre.
Stevenson, David . . .	Gas-Works, Dawsholm, Glasgow.
Walker, Henry	Coalmaster, Bathgate.

THE ASSESSMENT OF GAS-WORKS.

The PRESIDENT: I have received two questions to be put to the meeting. The first is—Can any one kindly explain how the annual value or rental of a gas-works is made up for the purpose of municipal assessment? If members think of taking up and answering such questions, the usual course would be that they should come up at the conclusion of the business set down on the programme. This will give members time to consider the question, for it is a very important one. Endeavours have been made to get up a discussion on the subject in the columns of the JOURNAL OF GAS LIGHTING. It is a question which affects all parties, and one which cannot be settled in a moment. There is great diversity of opinion on the subject; but if the meeting wish to take it up, now is the time to say so.

Mr. WATSON (Stirling): I think the person asking the question should go to counsel for an opinion, and pay the usual retainer.

Mr. M'GILCHRIST: I object to these remarks. This is a common cause, and I think we ought to try and fight it. I should be in favour of the appointment of a committee to inquire into the system of charging, and I have no doubt a general system could and would be introduced for the whole of Scotland, under which many people would derive advantage. It might be that if common action were taken, gas managers would be furnished with weapons with which to fight assessors.

Mr. BLACK (Alexandria): I think that there are persons here who would be able to give an opinion.

Mr. NIVEN: I shall be very glad if any one present will volunteer some information. I must say that I do not very well understand the principle upon which the assessor proceeds. It might be proper to obtain the opinion of a solicitor, but I thought this Association was very much of the nature of a Mutual Improvement Association, and it was on that ground that I sent the question up to the President.

The PRESIDENT: I do not think it is proper to go into explanations. If there is to be a discussion it ought to come up in its proper place at the end of the regular papers.

It was then agreed that the discussion on the question should be taken at the next meeting.

GAS MANAGERS AND THE FRANCHISE.

The PRESIDENT said there was another question on his paper, and it was this: Have gas managers the right of voting in an election, and, if so, what course ought they to take to obtain the privilege?

Mr. MITCHELL said the last question was so simple that it ought not to have been put.

The PRESIDENT said his opinion was that they ought not to interfere.

Mr. MITCHELL remarked that that was his opinion; but a gas manager could not exercise the franchise unless he paid rates.

The further consideration of the question was deferred till next meeting.

PRESIDENT'S VALEDICTORY ADDRESS.

The PRESIDENT then delivered the following Valedictory Address:—

As my term of office as your President expires to-day, it is necessary that I should offer some remarks on a few subjects more or less interesting to us all. In doing this, I shall be as brief as possible. Before entering on these matters, I cannot help expressing to you the great pleasure it gives me on observing so many of the profession and others met here to-day. If the number of gentlemen here assembled—many of them from great distances, and here, I have no doubt, at considerable inconvenience to themselves—might be taken as an evidence of the great interest shown in the affairs of this Association, then I say we have every reason to congratulate ourselves, for it proves that our Association still continues to have a vigorous growth, and also shows the attention given by the outside public to the various subjects that from time to time are discussed by us.

This Association is now entering upon the eighth year of its existence, and I presume there has been no year in its history in which there has been felt more anxiety as to the future of gas manufacture than the year just closed. During that time we had very prominently forced upon us a new method of public lighting—viz., that by electricity, the introduction of which, it was thought at one time, would revolutionize our whole system of artificial lighting. This naturally caused some anxiety to prevail for a short time amongst those having charge of gas-works and others interested in the gas industry; but, happily, we can all now look back and say there was no necessity for alarm, as this new mode of lighting by electricity has been pretty generally and fairly tried all over the country, and, for the present at least, has been found wanting both in general utility and cheapness, as compared with gas. Nevertheless, it is undoubted that, whatever the majority of gas managers might think, there was at one time, in the minds of many proprietors of gas-works, great anxiety as to the future value of their property. This feeling no doubt gave rise to great timidity in entering into any extension of works or mains, although, from the present depression in trade, and consequent cheap material and labour market, there never was a better opportunity for economically carrying out any such extensions.

The late "scare" respecting the electric light has not been an unmixed evil, for it has discovered, both to gas consumers and gas-works proprietors, that there is latent in gas and gas manufacture an undeveloped power. Gas consumers have discovered the fact that not only is gas a very cheap mode of lighting, but it is also very convenient and readily obtained at any moment. It is not necessary to make elaborate preparations by the erection of costly machinery; the means by which gas is supplied do not readily get out of order, and when they do, the remedy or repair is simply and inexpensively made. It is true that to burn gas with efficiency and economy requires more thought and care than has hitherto been bestowed upon it; but it does not require anything like the care and attention that must necessarily be devoted to the machinery for producing the electric light; in fact, if only the same attention were given when consuming gas as when burning oil or candles, not only would a better percentage of light be obtained from the quantity of gas burned, but a great saving in the expense or cost of the gas would be made.

We gas managers are modest men, and do not care to be constantly before the public lecturing and advising them as to the best method of burning gas; still it is necessary, from the want of knowledge shown by consumers in this matter, that we should take more prominent steps than we have hitherto done to draw attention to this subject, and the fact that there is almost as much skill required to consume gas efficiently as to make it, must be our excuse.

Thanks to the labours of Mr. Peebles and others, consumers have a means upon which they may rely with certainty of controling the supply of gas, so as to have an unvarying pressure, or to consume it at almost an unvarying quantity in each burner. Mr. Sugg, of London, has also rendered good service in showing what gas can do when burned in large quantities and in suitable burners. Many kinds of reliable burners are now to be had, and, therefore, we need experience no difficulty in indicating which are suitable and which are unsuitable burners; and if our suggestions are adopted, we may reasonably hope that consumers will be able to burn the gas as it ought to be burned.

It will thus become a public advantage that managers of gas-works have been aroused to the fact that they must endeavour to get gas consumers to give greater attention to, and also to adopt the means that science has shown to be necessary for efficiently and economically consuming gas, by having the piping throughout the houses of ample diameter and properly fitted, as also burners of a large size and of a non-corrosive material, so as to have unvarying apertures through which the gas may issue in an equal manner, and present when burning a flame of an equal and constant shape, and by the use of gas regulators to have the gas supply unvarying in quantity and pressure. There cannot be any doubt that a great deal of the feeling against gas suppliers that frequently exists in the minds of gas consumers, arises from ignorance of the proper methods of burning gas, which causes that great irregularity in the quantities consumed in similar periods of time—an irregularity which is often put down to deficiency in the quality of the gas, or something dishonestly done by the suppliers of it, which causes the gas account to be larger at one time than another. No doubt as this ignorance disappears, and consumers are made aware of the fact that by paying more careful attention to the mode of burning their gas they will find their accounts more uniform in amount, they will acquire greater confidence in the gas manufacturer, and any suspicions they may now have would be dispelled through the saving of gas that would be effected.

Proprietors of gas-works have also seen that to keep up the value of their property, and to provide against any casualty that may arise from the introduction of other systems of lighting, it is necessary that they should endeavour to find other uses for gas as well as that of giving light. The question of heating by gas has hitherto, especially in Scotland, received very little attention. In England, more attention has been paid to it, and in many manufacturing towns there is a large consumption of gas for heating purposes alone. English gas manufacturers are also becoming daily more alive to the importance of improving this branch of their business. To do this, exhibitions of gas-heating appliances, gas-engines, &c., are being held in all parts of the country, with great success and advantage, and not only so, but some gas companies are taking up the plan of letting stoves out on hire, and even doing cooking on a large scale for nothing, to encourage that plan. We, in Scotland, have done nothing, or

very little, in this way of public demonstration to show the advantage in cleanliness and economy to be derived by using gas for heating purposes.

To use gas in cooking-stoves, gas-engines, or for the heating of shops and dwelling-houses, is certainly a step in advance; but even these are but a few of the many purposes for which it might be used, for there is no reason why gas should not be applied to every purpose for which fuel is at present employed.

By the use of tubular boilers—and very small tubes might be used—there is no doubt steam could be raised for all purposes of a stationary character, such as in mills and factories, &c., with greater economy, convenience, and rapidity than as now done with coal, and at the same time do away with the great smoke nuisance in towns, which makes our manufacturing centres often so unpleasant to live in. It is scarcely possible to realize the immense improvement that would take place in all towns, the saving in health and property, if all the heat required for raising steam, warming houses, cooking, &c., were supplied from the gas-works. That this is not an extravagant idea is shown by the fact that it is done every day, but on a much more limited scale than might be; and we have only to remember that, except for about one-third of the year, a great portion of the manufacturing and storeage plant of a gas-works is comparatively idle, to see at once how important to gas manufacturers is this question of utilizing gas for raising steam, and heating purposes generally. Not only would our plant be better employed, but, from the greater quantity of gas supplied, it could be sold at a much lower rate, and so render the more impossible, competition by any other source of lighting.

You will have an opportunity to-day of inspecting the handsome new works of the Coatbridge Gas Company, which have now been opened. I cannot do better than call your attention to these works in their various details, seeing that it gives me an opportunity of comparing the present position of gas-making with what it was some years ago. This will enable us to recognize the many improvements that have taken place of late, and the direction these improvements should continue to take.

It has frequently been said that little advance has been made for many years in the different apparatus connected with gas manufacture, but although it may be true that the processes are very similar, an inspection of these new works will at once show the great strides that have been made in all the details of the processes of gas manufacture during the past few years.

Instead of the narrow, dark, and confined retort-houses, with low roofs, you will now see houses both spacious and lofty, well lighted and well ventilated. Retort-houses are now constructed of ample span, and, in this instance, only separated from the coal-stores by cast-iron columns, so that these stores form one with the retort-house. There is, consequently, larger air-space; the height of the roof prevents all chance of the men being annoyed by heat, smoke, or steam; they have perfect freedom to do their work, and that with as little fatigue as the nature of the work will admit of. All these improvements recognize the principle that economy in the retort-house is not only effected by having a well-arranged retort-bench, but also by giving the workmen ample light, air, and space in which to do their work. Under these circumstances, the men will work with better heart, with less wear and tear to themselves, with less confusion and more cleanliness, and, I am sure, more efficiently and more economically, than in a retort-house of the old school.

By an excess of retort power, and ample room for extending the same, the advantage is taken in a great many works of almost entirely doing away with Sunday labour. This great improvement, which I am glad to say is being adopted everywhere that it is possible to do so, is not only a great boon to the workmen, but also to the gas managers, and is an arrangement that we know the proprietors of gas-works have at least no reason to regret.

In these works you will observe that the exhauster-boilers are in the retort-house, so that all the furnace work is confined to the one house, and there are many other matters of detail, including a new arrangement of dip-pipes; but to these I do not refer, as Mr. Mitchell has kindly made this the subject of a paper which he will read to-day. There are also some matters in connection with the roof and other portions of the retort-house, which it will be well to take note of, but for me to go into them now would take up too much time.

The condenser arrangements here are not yet finished; but you will notice that, instead of the old-fashioned plan of having only one condenser, through which the whole of the gas must pass, no matter how small the make may be, or how low the atmospheric pressure, we have an arrangement by which the condensing power can be adjusted to the necessities of make or temperature. This is another stride that has been made in the process of gas manufacture. We still condense the gas in a similar manner to that formerly adopted, but instead of a hap-hazard sort of way, the condensing of gas is now carried out with a knowledge of the principles and necessities of what is required. We know that if the gas is condensed too rapidly, or the process is carried on too long, so that the temperature of the gas is reduced to a very low point, it will be seriously robbed of its illuminating constituents, to the advantage only of the tar distiller. Again, if the gas is allowed to leave the condensers at too high a temperature, the after-process of purification will be seriously impaired. It is evident, therefore, that the process of condensing is one requiring careful attention, and that if we wish to conduct the manufacture of gas in keeping with the present knowledge and experience of this important part of purification, we must now guide ourselves by the use of thermometers, and increase or decrease our cooling surface as necessity requires.

If anything be wanted to show how much exhausters are felt to be a necessity, and how much they are appreciated, an inspection of the handsome exhauster erected at these works will be sufficient. They are by English makers, and are of beautiful workmanship and finish. The question as to whether exhausters do assist in materially causing the coal to yield an increased quantity of gas, is, we know, disputed by some of our members; but there cannot be a doubt in the minds of any that have used them that, during what may be called the lifetime of a set of retorts, certain contingencies arise, from wear and tear, old age, or accident, which necessitate retorts being patched and repaired, and these repairs are effected at a serious loss of gas unless an exhauster is used. Even in the case of new retorts, it is of advantage to have the back pressure, due to the weight of holders and friction, reduced to a minimum; for no attempt is, of course, made to remove any of the pressure due to the barometric pressure of the atmosphere, as that would be destructive to the quality of the gas. It is a well-known fact that the exhauster assists in keeping down carbon accumulation, and that it also relieves the labour of the stokers in closing the retort-lids. In fact, I know of no more valuable agent in a gas-works; and, although many of our members cannot afford to emulate our Coatbridge friends in this matter, still there are many simple and inexpensive arrangements of gas exhausters that might be adopted, and, beyond the first cost, there need be little outlay, except the cost of fuel, while the engine that drives the exhauster may be made to do much necessary work, such as filling casks with tar, working scrubber pumps, &c., although it is better to have the latter working apart. Still, in a small work, it is impossible to have all we could wish. In the scrubbing or washing of gas as now conducted it is again noticeable that some advancement has been made towards bringing this department of our manufacture as near perfection as possible. It is now recognized that not only must we remove the ammonia as a means of purification, but it is also advantageous to do so as a matter of profit. It is impossible to work up the gas liquor to a marketable strength in a single scrubber without loss of ammonia; for no matter how efficiently the scrubber may act in enabling the ammonia to combine with the sulphur and carbonic acid compounds, there is always some free ammonia which, when the liquor is worked up to beyond a certain strength, will leave the liquor and pass off with the gas. This results in the loss of ammonia in a marketable form, and necessitates its being removed in the after-process of purification. To enable the whole of the ammonia to be obtained, and to allow of the liquor being worked up to a good strength, it is necessary to have two or more scrubbers. It is also now acknowledged that to over-wash the gas is very objectionable, and it is evident that if only one scrubber is employed, and that sufficient to do the work during the term of maximum make, that when only a small quantity of gas is passing through the scrubber the gas is very liable to be over-washed; but when two scrubbers are employed, as in these works, the washing can be adjusted as circumstances may require.

The pipes and valves, in connection with the condensers and scrubbers, are here all above ground, and an inspection of these in detail will be of interest to all.

Although we are still looking for means by which a saving of labour and material can be effected in the complete removal of sulphuretted hydrogen and carbonic acid, still in our purifiers, as now constructed, we again see that we have made an advance upon the old practice, in having ample surface in proportion to the quantity of gas made, ample room for getting about them, and plenty of freedom for the escape of all offensive smells, so that the men in cleaning the purifiers can work with some degree of comfort; also convenient means for removing the spent and bringing up the fresh lime; all showing that, although we use dry lime in the same manner as when that process was first introduced, it is now done in a more rational and scientific manner.

In the gasholders the advantage of ample storeage is recognized as a point of true economy. We all know that it is no gain to be confined to a storeage that will only meet our necessities from day to day, and also that there is scarcely a more profitable investment of capital in any part of a gas-works than in that of erecting a gasholder of surplus capacity.

The advisability of surplus yard room, with convenient and ready means of extension, is now too well known to need comment, and this has been well attended to in the present instance.

These works are not only a credit to the Directors of the Company, in showing their foresight and endeavour to keep up with the improvements of the age, and to their Engineer, Mr. Mitchell, the designer of the works; but I am sure their careful inspection by us to-day will not be the least profitable and instructive of our proceedings here.

It is well to bear in mind that we are progressing in knowledge; that we, in conducting the various processes of gas manufacture, have become more scientific, more expert in designing our apparatus to arrive more exactly at the ends we wish, and are better acquainted with utilizing the raw material with which we have to deal, getting at our results with less loss of material, and the products derived from it. At the same time we must not forget that there is considerable room for improvement, and that a great deal of crudeness still exists in the process of gas manufacture. We have yet to perfect the means of keeping our retorts at an unvarying temperature; of preventing waste of gas while charging retorts; of providing and supplying gas of an unvarying quality; of means of preventing the deposit in our retorts of the richer illuminating constituents of the gas; and we have yet to bring into practical every-day working a means of conducting the process of manufacture without the necessity of so much handling of the crude material for purifying purposes. To obtain these advantages we have much scope for study and experiment.

Before concluding, I should like to thank the office-bearers and other gentlemen connected with our Association for the valuable assistance I have at all times received from them during the time I have acted as your President, and to express my wish for the continued success of the West of Scotland Association of Gas Managers.

(To be continued.)

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Although the coal trade of this district is generally very dull, business has been helped up a little for the better classes of round coal by the exceptionally cold weather, which has caused house-fire coal to move off a trifle more freely than would otherwise have been the case at this season of the year, and the Durham strike, which is still bringing a few extra orders for the South of England markets into this district. There is, however, a good deal of short time being worked throughout the Lancashire coal-field, and the prospects for the summer are anything but encouraging. In the gas coal trade there is still but little actual business being done. A good many tenders have been sent in, but as yet very few contracts have been settled. For this class of fuel the tendency of prices is to be easy, and there is little doubt that consumers will this season secure contracts on very low terms. Common classes of round coal continue abundant in the market, and very bad to place, even where sellers are willing to take extremely low prices. Engine classes of fuel are without material change; for some of the best sorts there is a fair inquiry, but as supplies are still generally very plentiful, no better prices whatever are being obtained. The average quotations at the pit's mouth may be given about as under:—Good Wigan Arley, for house-fire purposes, 8s. to 8s. 6d. per ton; common qualities, 6s. 6d. to 7s.; Pemberton four-feet, 6s. 3d. to 7s.; good ordinary Lancashire screened gas coal, 6s. 6d. to 7s.; common coal, 4s. 6d. to 5s. 6d.; burgy, 3s. 9d. to 4s. 3d.; and slack, 2s. 6d. to 3s. 3d. per ton.

Rather more coal seems to have been going away for shipment, but the prices taken continue extremely low.

There is no improvement in the coke trade, and the requirements of consumers in this district are so small that even the strike in the Durham district has had no effect here.

The iron trade is still in a very depressed condition, both as regards raw and finished materials. Lancashire makers of pig iron, although they are offering at extremely low figures, are doing but a very small amount of business, and manufacturers still complain of the scarcity of orders and the unremunerative prices which have to be taken. For Lancashire pig iron, delivered into the Manchester district, the selling prices range from 45s. to 46s. for No. 3 foundry, less 2½, and 1s. per ton under this for forge; and for bars, £5 10s. to £5 15s. per ton.

In some branches of the engineering trade there is more activity on foreign orders, but the home demand continues extremely dull.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The great strike in the Durham mining district is virtually at an end. The Joint Committee of Coalowners and Miners would conclude their

arrangements on Saturday night. The ponies and gear have been put down several mines. Part of the collieries may be set on on Monday. An effort is being made to do so. The whole of the Durham pits will, no doubt, be at work on Wednesday. Arrangements have been made, that as soon as the best collieries re-commence they will begin to supply first their regular customers, and those with whom they have contracts running. Gas coals are much in request for the Baltic and the Italian ports of the Mediterranean; but as so many of the best gas coals are contracted for in advance, there is only a limited quantity for sale in the open market. The coalowners will not name a price for them; but it is quite likely an advance will be made.

There will not be much difficulty in procuring steam tonnage for the gas trade. Owners of steamers are hanging back, however, for higher rates. There will be no great rush to enter upon business until the gas-coal trade is actually opened again. Small sailing vessels, British and foreign, will be scarce. They have been scattered about in all directions since the strike commenced. Much higher rates of freight have been asked by the owners of this class of vessels, and no doubt will be obtained. There is a steady demand for coke, which is now scarce, through the long strike having exhausted stocks.

The Northumberland miners have given notice to the Steam Coal Assotion for an advance of wages. A deputation have waited upon the Association, and there has been a talk more with regard to establishing a permanent board of arbitration or a sliding scale, than to enforce a demand for an advance of wages. The Northumberland coal-field is not at all likely to be disturbed by a strike at present. It is quite certain also that both parties in the county of Durham will think twice before they enter upon a second strike such as the one that is now closing. The masters have had trouble enough through it, and the men and their families have felt the pinching of hunger pretty keenly. The men will have to work a fortnight before they get wages.

Very little shipping business was done last week, but the chartering of vessels will go on very briskly this week, as merchants have a great number of orders in hand.

The general manufacturing trade of the North of England is extremely dull. The chemical market is in a very depressed state.

NEWCASTLE-ON-TYNE, *Monday.*

The inability of the Joint Committee of the Durham Coalowners and Miners, after a sitting of many hours at the Wool Memorial Hall, on Saturday, to bring the strike to a termination, has been a great disappointment to every one connected with the gas coal trade. A number of steamers and sailing vessels had been freighted to load gas coals, and it was expected that they would have been just in time to-day. The Committee will not re-assemble until Wednesday next. It will be this day week at the earliest before the pits are started, and it will be the Tuesday or Wednesday following before boats begin to load gas coals at the Tyne dock, if then.

NEWCASTLE-ON-TYNE, *Monday Night.*

Affairs are in a sad muddle in the Durham coal district. I have spoken to the fitters of the leading firm in the gas colliery trade, and there are no prospects at all of the pits being got to work this week. It is even not certain that matters will be settled on Wednesday, when the Joint Committee meets again. There seems a radical difference in their views with regard to the proposed basis for a settlement. If the pits are not at work on Thursday, the charters which have been made for steamers will be declared off.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The annual general meeting of the Kilsyth Gaslight Company was held last Tuesday, when a dividend of 7½ per cent. was declared. It was reported that the income for the past year was £1555, and the expenditure £1364. The sum of £416 was expended during the year in the renewal and improvement of the works.

On the recommendation of the Corporation Gas Committee of Aberdeen, Mr. Alexander Smith, the Gas Manager, has been empowered to procure one of Wigham's lanterns and burners, costing about £17, and two of Bray's lanterns and burners, costing £6 each. This recommendation was consequent on the success of experiments recently made with one of Sugg's new "London" Argand burners and lanterns in Castle Street, Aberdeen.

At a meeting of the Lighting Committee of the Dundee Police Commission, last Wednesday evening, the subject of improving the lighting of the High Street of the town was under consideration. The propriety of erecting two large and improved lamps was discussed, and it was ultimately remitted to Mr. M'Crae, the Gas Manager, to bring up a report on the subject.

Edinburgh Gas Company's stock was disposed of last Thursday at £45 7s. 6d., and shares of the Edinburgh and Leith Gas Company changed hands at £32 10s. On the following day, Glasgow Corporation 9 per cent. Gas Annuities were in demand at £1 higher, at £206; and on the same day buyers were offering £146 for Edinburgh Corporation Water Annuities, being an advance of 10s.

The town of Musselburgh has got rather into a muddle in connection with the proposal to take a supply of water from the Edinburgh and District Water Trustees. At one time they proposed to make a charge of 6d. per 1000 gallons, which would have been quite prohibitive, as the sum necessary to be levied under such an arrangement would have raised the entire rates of the burgh to something like 8s. per £1 of rental. Then, after much negotiation, the Water Trust said their intention was to charge 3d. per 1000 gallons; but the Town Council Committee on Water Supply thought that 2d. was quite a sufficient sum to give. At a meeting of the Town Council, held last Thursday, it was resolved, by a majority of 5 votes to 4, to proceed immediately with the necessary works of laying the pipes, &c., and to bring the case of the pecuniary difficulty under the notice of the Sheriff. A loan of £10,000 is to be raised to meet the circumstances of the case.

During the fortnight ending on the 6th inst., the delivery of water into Edinburgh and districts was equal to 38·06 gallons per head per day to a population of 292,500. On the date mentioned, the total quantity of water stored was 2,500,687,000 gallons, as against 2,492,126,000 gallons on the 22nd ult., and 537,877,349 gallons on the corresponding date last year.

Last Friday's Glasgow pig iron warrant market was quiet, and prices suffered a further decline, closing 3d. per ton under those of the preceding day, and fully 8d. per ton under the previous Friday's close. The closing quotations were—buyers, 42s. 10d. cash, and 43s. one month; sellers 1d. per ton more.

There is not much alteration to note in the home department of the coal trade. If anything, the consumption is less, and household coal is more depressed. The foreign orders, however, have been better of late, and the shipments have considerably improved. Prices remain very low. The following are the quotations for several well-known varieties of Scotch cannel coal shipped on the Clyde or on the Forth:—Lesmahagow, 30s. 6d. per ton, f.o.b. Glasgow or Grangemouth; Kinneil, 22s. 6d. f.o.b. Leith, and 20s. Bo'ness; Haywood, 25s. f.o.b. Granton, 26s. Leith, and 27s. 6d. Grangemouth; C. D. Lesmahagow, 15s. 3d. f.o.b. Grangemouth, Leith, and Greenock; Longlee, 17s. f.o.b. Leith, and 16s. Glasgow; Niddrie, No. 1, 22s. f.o.b., Leith; Drum Park, 11s. 6d. f.o.b., Leith, and 11s. Glasgow; Arniston, 26s. per ton.

REDUCTION IN THE PRICE OF GAS AT DOWLAIS.—The Directors of the Dowlais Gas and Coke Company, Limited, have just given notice that the price of gas will be reduced, after the 30th of June next, to private consumers, from 4s. to 3s. 9d. per 1000 cubic feet; and to the Local Board, for the public lamps, from £3 15s. to £3 12s. 6d. per lamp per annum, including lighting, extinguishing, cleaning, and repairing.

BRIGHTON CORPORATION WATER-WORKS.—The Water-Works Committee reported to the quarterly meeting of the Brighton Town Council, held last Wednesday, that the water-works accounts for the year ending Dec. 31, 1878, showed a balance of £4485 6s. 10d., on a revenue of £33,000. It was resolved that the sum of £4000 be transferred to the borough-fund, and that the balance of £485 6s. 10d. be carried to the credit of the contingent-fund.

SALE OF SHARES IN THE GUILDFORD GAS COMPANY.—Last Wednesday there were sold by auction a number of shares in the Guildford Gaslight and Coke Company, realizing excellent prices. The lots sold as under:—Lot 1. One £25, class A, paid-up share, now paying a dividend of 10 per cent. per annum—£50. Lot 2. Two £10, classes C and D paid-up shares, now paying 7½ per cent.—£15 per share. Lot 3. Three £10, class D, paid-up shares, now paying a like dividend—£16 per share. Lot 4. Two £10, class E, shares, ditto, £15 10s. per share. Lot 5. One £10, class F, share, now paying 7 per cent.—£14 per share. Lot 6. One £10, class G, share, and one £3, class B, share, now paying 5 per cent.—£15 for both. Lot 7. Two £10, class E, shares, now paying 7½ per cent.—£15 10s. per share. Lot 8. Two similar shares—£15 10s. per share. Lot 9. Two similar shares, and one £10, H, share, paying 7 per cent.—£15 per share.

TOTNES GAS COMPANY.—The annual meeting of this Company was held on the 5th inst.—Mr. W. Chester in the chair. The accounts presented showed a balance of £458, out of which the Directors recommended the addition of £100 to the reserve-fund, and the payment of a dividend of 7 per cent. (free of income-tax), amounting to £327, leaving a balance of £30 to be carried forward. In moving the adoption of the report, the Chairman stated that as a great deal of dissatisfaction had been expressed at the town being so dimly lighted by petroleum, the Directors felt that they ought to take some steps to effect an improvement. They had, therefore, incurred considerable expense in laying down additional mains, hoping by so doing to show to the Town Council that it was to the interest of the inhabitants that the town should be lighted by gas, and to induce them to grant the Company a three years contract for the supply of the public lamps. The report was adopted, and the retiring Directors and Auditor were re-elected. A vote of thanks to the Chairman terminated the proceedings.

LECTURE ON ARTIFICIAL LIGHT.—On the evening of the 29th ult., a lecture on "Artificial Light" was delivered by Mr. S. A. Luke, in the School Room, Sudeley Place, Brighton. The lecture was illustrated with some very successful experiments, and the comparative cost of light from different sources was indicated by diagram—paraffin oil costing, for a certain amount of light, 8½d.; London gas, 9½d.; electric light, 5s. 5d.; tallow candles, 8s.; paraffin candles, 8s. 4d.; composite candles, 9s. 8d.; wax candles, £1 3s. 8d.; showing a large difference of cost to produce an equal lighting effect. In the course of the lecture, Mr. Luke touched, of course, upon the electric light, and exhibited various carbon lamps for producing it. He also stated that in Paris it had been necessary to maintain gas-lamps ready for lighting up when any stoppages of the electric light occurred. These stoppages were very frequent, and lasted from 20 to 40 minutes. Wherever tried, the electric light had, the lecturer said, been found be to costly, troublesome, and uncertain.

FATAL EXPLOSION AT THE PRESTON GAS-WORKS.—Last Friday an explosion of gas occurred at the Walker Street works of the Preston Gas Company, entailing considerable loss on the Company, besides causing the death of one of the men employed at the works. It appears that about four o'clock in the afternoon a tremendous explosion was heard to proceed from the station-meter and governor house, and it was found that the north and south walls of the building had been blown out, while among the shattered brickwork the dead body of a man, who had been employed in the joiner's shop, which occupied the second floor, was discovered. It is supposed his death was caused through being struck by the bricks, &c., which were sent flying in all directions, as several cuts and bruises were about his head and body. Some pieces also pierced the sheets of one of the gasholders, and, the escaping gas becoming ignited, the whole of it was speedily consumed.

MONTE VIDEO WATER-WORKS COMPANY.—This Company, which was registered on the 6th inst., proposes to carry into effect an agreement of the 28th ult., between Ambrosio Placido Lezica, Anacarsis Lanus, Teofilo Lanus, Juan Lanus, and Enrique Fynn, of the one part, and the Mercantile Bank of the River Plate of the other part, for the acquisition of the Monte Videan Water-Works, and all concessions already or to be hereafter granted by the Government of Uruguay, or Banda Oriental, or the Municipality of the City of Monte Video. The Company is incorporated with a capital of £400,000, in £20 shares. The ordinary Directors are to receive a minimum sum of £1000 per annum until the use of the Company's water is made obligatory upon the inhabitants of Monte Video, and afterwards a minimum sum of £1500 per annum. Power is taken to issue to the Mercantile Bank of the River Plate, or their nominees, mortgage debentures for £250,000, to be a first charge on the undertaking and property of the Company. These are to bear interest at 7 per cent. per annum, and are to be redeemable by a sinking-fund of £5000 per annum, to be set aside out of the profits and income of the Company.

ALIZARINE AND ALLIED COLOURING MATTERS.—Last Thursday, at the meeting of the Society of Arts, Mr. W. H. Perkin, F.R.S., gave the first of two lectures on the "History of Alizarine and Allied Colouring Matters," and their production from coal tar. The chair was occupied by Professor Abel, F.R.S., who, in opening the proceedings, expressed, on behalf of the Council, their unfeigned sorrow at the sudden and untimely decease of Mr. T. Wills, the late Secretary of the Chemical Section. Mr. Perkin, in beginning his lecture, said he had hoped to give a full account of the progress made in the development of dyeing by colours produced from coal tar, since he gave a series of lectures on this subject some years ago. He found, however, that the subject was far too large to take up in its entirety, and therefore confined himself to the most important colouring matter—alizarine and its allies. After describing the properties of the madder root, and the mode of dyeing in which it was employed, and also the method known as Turkey red dyeing, he went on to explain the chemical composition of the various colouring matters used in these processes, and narrated the various steps by which they had been isolated from coal tar, illustrating the lecture by numerous experiments. The discussion was adjourned until after the second lecture, which is appointed for Thursday, the 22nd inst.

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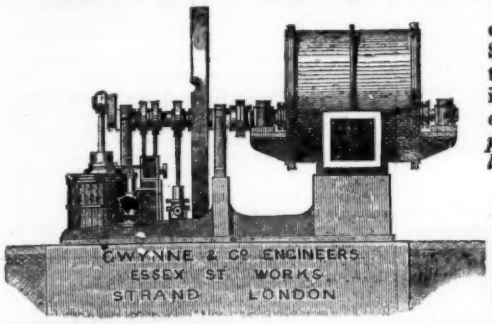

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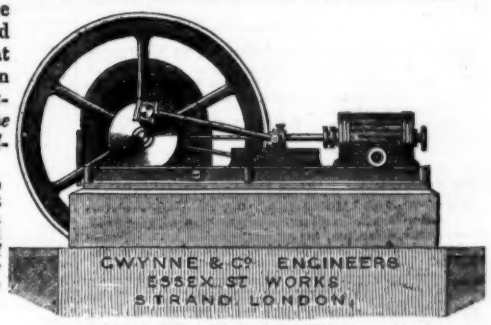

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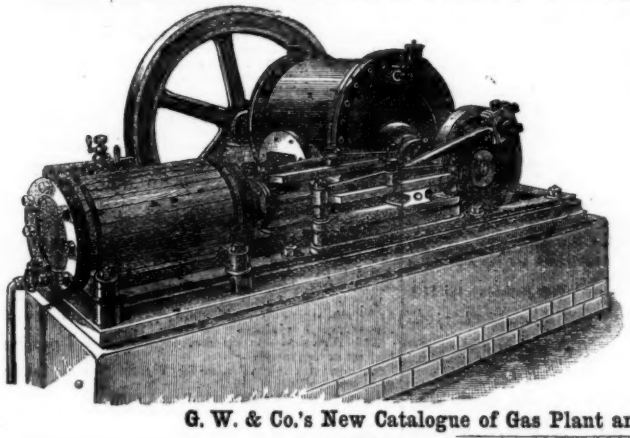

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GAS-WORKS, BURNHAM, BUCKS.

WANTED, a Steady and Respectable Working MANAGER, who thoroughly understands Gas-Making in all its branches. Wages £1 per week. House-rent, firing, and gas.
Apply to Mr. W. LETT, Secretary, High Street, Burnham, BUCKS.

TO CLERKS OF WORKS.

THE Watford Local Board of Health require the services of a CLERK OF WORKS to Superintend the Construction of a Brick Reservoir. Salary Two Guineas per week.
Written applications, accompanied with copy of recent testimonial and reference to last employer, must be received by me not later than Thursday, May 15.
The person appointed will be required to devote the whole of his time to the work. If overtime required, it will be paid for at the above rate.
JOHN SEDGWICK, Clerk to the Board.
66, High Street, Watford, Herts, May 6, 1879.

EXHAUSTER FOR SALE.

FOR SALE, an Engine and Exhauster combined, to pass 7000 feet per hour, together with Boiler, 12 ft. by 4 ft., Boiler Fittings, Connections, Regulator, and Stone Bed.
For particulars, apply to W. T. TEW, Gas-Works, WARWICK.

PURIFIERS FOR SALE.

FOR SALE—The Plates forming a Set of Two Purifiers, 12 ft. by 4 ft. 6 in. by 4 ft. deep, together with wrought-iron Covers, Lifting Tackle, Wood Sieves, Hydraulic Valve and Connections. The above are all equal to new, and very handy, requiring little floor space.
For particulars apply to GRAHAM ROSS, Gas-Works STONEHAVEN, N.B.

PURIFIERS FOR SALE.

THE Ventnor Gas and Water Company have FOR SALE, Four 6-ft. Square PURIFIERS, with Centre-Valve and Connections complete.
Further information may be obtained from FLETCHER W. STEVENSON, Secretary and Manager.

A Dozen Tanks, 3-16ths and ¼-in. Plates, well stayed, and from 1000 gallons to 3000 gallons, all just new, are FOR SALE cheap. Also an AIR-PUMP and ENGINE, £20; a CENTRIFUGAL PUMP, 3-in. delivery, £6; and an Egg-end BOILER, £12; also some Large Wooden Tanks.
Apply at the Colour Works, Frogmore, WANDSWORTH.

TO BE SOLD, Cheap, Three Telescopic GASHOLDERS, two 60 ft. diameter and 20 ft. deep each lift, and one 70 ft. in diameter and 20 ft. deep. Only been in use eight years. May now be seen at work at the Effingham Street Gas-Works, Sheffield.
For price, apply to THOMAS PIGGOTT AND CO., Spring Hill, BIRMINGHAM.

THE Sunbury-on-Thames Gas Company have FOR SALE the following PLANT in good condition, thrown out to give place to larger:—
Two Purifiers, 6 ft. by 3 ft. by 3 ft. 6 in. deep.
Two do., 5 ft. by 3 ft. by 3 ft. deep.
6-in. Connections, with two Lifting Screws and Travellers complete.
Six 6-in. Cathels's Patent Four-way Valves.
Station-Meter to pass 1500 ft. per hour, 4-in. Connections.
4-in. Governor.
5-in. Pipe Condenser.
Six 6-in. Donkin's Valves.
For further particulars apply to Mr. JOHN SMITH, Manager, Gas-Works, Sunbury-on-Thames, MIDDLESEX.

GASHOLDER FOR SALE.

THE Sleaford Gas Company, Limited, have for disposal a GASHOLDER, 32 ft. in diameter by 14 ft. deep, with Counterbalance Weights and Chains, Stone Columns, 5-in. Inlet and Outlet Pipes, Syphons, and Slide-Valves, all complete, the whole in splendid condition and at present in use. To be moved to make room for extensions.
Can be seen, and full particulars obtained, on application to the undersigned.
By order,
HARRY WIMHURST, Manager.
Gas-Works, Sleaford, May 7, 1879.

ROSSENDALE UNION GAS COMPANY.

TENDERS are invited for the Supply of COAL, SLACK, and CANNEL for a term of One, Two, and Three years, from the 30th of June next. Quantity required per annum about 9000 tons of Coal and 5000 tons of Cannel.
Tenders to be sent in not later than June 3, 1879, and addressed to the Chairman of the Gas Company, endorsed "Tender for Coal and Cannel."
JAMES RILEY, Manager.
Clough Fold, near Manchester, May 8, 1879.

IN THE MATTER OF THE SOUTH METROPOLITAN GASLIGHT AND COKE COMPANY AND THE SURREY CONSUMERS GAS COMPANY.

NOTICE is hereby given that a scheme for the Amalgamation of the South Metropolitan Gaslight and Coke Company and the Surrey Consumers Gas Company, in pursuance of section 64 of the South Metropolitan Gaslight and Coke Company's Act, 1876, has been submitted to the Board of Trade; and notice is hereby further given that a copy of the proposed scheme of amalgamation may be obtained upon application at the Offices of the Board of Trade in Whitehall Gardens, and that any person or persons wishing to bring any representations or objections to such scheme before the Board of Trade, may, within three weeks from the date of this advertisement, forward a statement in writing of such representations or objections to the Assistant-Secretary, Railway Department, Board of Trade, and must at the same time forward a copy of such representations or objections to Messrs. BAXTERS AND COMPANY, 6, Victoria Street, WESTMINSTER, the Agents for the promoters of the Scheme.
Board of Trade, May 5, 1879.

THURSDAY, JUNE 19, AT THE MART, AT TWO.

MESSRS. Edwin Fox and Bousfield are honoured with instructions to place £100,000 Ordinary A Consolidated Stock of The Gaslight and Coke Company, being the first portion of additional capital authorized to be raised by resolutions passed at a General Meeting of Proprietors, held on Friday, Feb. 14, 1879, in pursuance of the powers of The Gaslight and Coke Company Act, 1876, and they will, in accordance with the provisions of the said Act, submit the same to competition at the Mart, Tokenhouse Yard, on Thursday, June 19, at Two o'clock precisely.
The dividend for the year 1878 was 10½ per cent., and this is capable of very great increase, for under the said Act a further dividend of ½ per cent. beyond 10 per cent. may be paid for every penny by which the price of the gas supplied is reduced below the initial price of 3s. 9d. per 1000 feet. This has been reduced, and the dividend consequently raised in proportion, in the 18 months since the passing of the Act, to 3s. 6d. per 1000.
The stock will be divided into large and small lots, to suit the convenience of buyers.
Particulars may be obtained at the Offices of the Company, at Horseferry Road, Westminster, and of Messrs. EDWIN FOX & BOUSFIELD, 99, Gresham Street, BANK, E.C.

GAS PLANT FOR SALE.

A 10-in. Vertical Pipe Condenser, having 20 Pipes, each 19 ft. high, on Cast-Iron Base Box.
A Scrubber, 16 ft. high 5½ ft. diameter, fitted with thin boards, Self-Acting Liquor Distributor, 10-in. inlet and outlet pipes.
Two Single-Flue Cornish Boilers (new in 1870), each 9½ ft. long, 3 ft. 9 in. diameter; Fire Tube of Low Moor Iron, complete with all Fittings.
All in good working order; removed to make room for larger plant.
For further particulars apply to THOS. TREWHITT, Gas-Works, WEST HARTLEPOOL.
May 8, 1879.

TO RETORT SETTERS.

THE Directors of the Horsham Gas Company, Limited, invite TENDERS for the renewal of about 30 Fire-Clay RETORTS.
Tenders to be sent in on or before Saturday, the 17th inst.
Full particulars may be procured by application to the undersigned.
R. SHEPPARD, Secretary.

TO MANUFACTURING CHEMISTS.

THE Gas Committee of the Keighley Local Board of Health are prepared to receive TENDERS for the TAR and AMMONIACAL LIQUOR manufactured at their Works, from the 1st of July next to the 30th of June, 1880.
Particulars and form of tender can be obtained on application to the undersigned, at the Gas Office, Low Bridge, Keighley, to whom tenders must be sent not later than the 26th inst.
By order,
JOHN LAYCOCK, Engineer.
Gas Office, Low Bridge, May 9, 1879.

IN VOLUNTARY LIQUIDATION.

FOR SALE BY TENDER.

THE Sawston (Cambs.) Gas-Works, Machinery, Plant, Mains, &c. The Works were erected about Ten years ago, and will be sold as a going concern in consequence of the Proprietors (the Sawston Gas Company, Limited) having been compelled, through embarrassments arising from insufficient capital, to pass a resolution for voluntary liquidation under sec. 129, subsec. 3, of the Companies Act, 1862.
The consumption of gas in Sawston is likely to increase, and under good management the Works would pay a handsome percentage upon the purchase-money.
All further particulars may be obtained on application to the Liquidators, F. PRINCE, Esq., M.R.C.S., and Mr. A. G. CHALLIS, Sawston, CAMBS.

MACCLESFIELD CORPORATION GAS-WORKS.

TO CONTRACTORS.

THE Gas Committee are prepared to receive TENDERS for the carrying out of the following Works, viz.:—
The conversion of a Gasholder-Tank into a Tar and Liquor Tank.
The Erection of Engine, Exhauster, Governor, and Pump Houses, and Extension of Retort-House.
The whole to be executed in accordance with plans and specifications, which can be seen, and bills of quantities obtained, at the Engineer's Office, Gas-Works, on and after the 20th inst., on payment of three guineas, which will be returned on receipt of *bona fide* tender.
Tenders addressed to the Chairman, Gas Committee, Town Hall, Macclesfield, to be sent in not later than Saturday, the 31st inst.
The Committee do not bind themselves to accept the lowest or any tender.
THOMAS MOORE, Engineer and Manager.
May 5, 1879.

BAHIA GAS COMPANY, LIMITED.
NOTICE is hereby given that the ORDINARY HALF-YEARLY GENERAL MEETING of this Company will be held at the Company's Office, St. Dunstan's House, Cross Lane, London, on THURSDAY, the 22nd day of May, 1879, to receive the Report of the Directors, the Balance-Sheet confirmed by the Auditors, and for general purposes.
The chair will be taken at Three o'clock precisely.
By order of the Board,
ALFRED J. HEAD, Secretary.
May 8, 1879.

BOROUGH OF BIRMINGHAM.

THE Gas Committee of the Town Council invite TENDERS for the Purchase of the surplus TAR to be produced and manufactured at their works at Adderley Street and Windsor Street, Birmingham, and at West Bromwich, for a period of One year, from July 1, 1879.
Tenders may be made for the supply from one or more of the works.
Further information and forms of tender may be obtained on application to me,
EDWIN SMITH, Secretary.
Offices of the Department, Old Square, Birmingham.

BOROUGH OF HALIFAX.

TO MANUFACTURING CHEMISTS.

THE Gas-Works Committee of the Halifax Corporation invite TENDERS for the Purchase of 1500 Tons of GAS TAR, to be removed from their Gas-Works between July 1, 1879, and April 1, 1880. The Tar may be loaded on the Gas-Works railway siding.
Further information may be obtained on application to Mr. William Carr, Gas Manager, Halifax.
Tenders, properly endorsed, must be sent to me on or before the 29th inst.
By order,
A. C. FOSTER, Town Clerk.
Town Hall, Halifax, May 2, 1879.

THE Hampton Court Gas Company have FOR SALE, One 40 ft. by 16 ft. GASHOLDER, with six Cast Columns and Wrought Girders. To be Sold for £25, as the position is wanted.
Also the following PLANT, the who'e of which is in excellent condition, having been removed for larger:—
One 8-horse Power Vertical Engine.
One 4-horse do. do.
One 15,000 feet Beale's Exhauster.
Two Beale's Slide-Valves for do.
Four Donkin's Valves.
Two Washers, with 8-in. Connections.
For further information, apply to Mr. E. PRICE, Engineer and Manager, Gas-Works, HAMPTON WICK.

WANDSWORTH AND PUTNEY GASLIGHT AND COKE COMPANY.

TAR AND LIQUOR CONTRACT.

THE Directors of the above Company are prepared to receive TENDERS for the TAR and AMMONIACAL LIQUOR produced at their Works, at Wandsworth, during the next Twelve months.
The Tar and Liquor to be removed by the Contractor, by barges, whenever required by the Company's Engineer. Monthly cash payments to be made.
The Directors do not bind themselves to accept the highest or any tender.
Tenders, marked "Tender for Tar, &c.," to be sent on or before the 19th of May.
North Street, Wandsworth, May 9, 1879.

CORPORATION OF NOTTINGHAM.—GAS DEPARTMENT.

TENDERS FOR COALS.

THE Gas Committee are desirous to receive OFFERS for supplies (amounting in the aggregate to 80,000 tons) of SOFT COALS and SOFT COBBLES or NUTS, for the period terminating on the 30th of April, 1880.
The Large Coals and the Cobbles or Nuts are to be separately delivered, where and as from time to time directed, by and at the expense of the Contractors, upon the Gas-Works Siding, Great Northern Railway, in the East Croft, at Nottingham, and at the Midland Company's Railway Station, at Nottingham, and also on the Gas-Works Railway Sidings, Midland Railway, at Radford and Basford respectively; and at and after the rate of one-eighth part of such total quantity in each calendar month, commencing with the month of July next, till the Corporation shall be satisfied with the amount of accumulated stock, and afterwards at such rate as shall be from time to time directed, till the agreed quantity shall have been delivered.
The Corporation will undertake to receive from each person or firm whose tender may be accepted, a total quantity of 5000 Tons at the least; but they do not bind themselves to accept the lowest or other tender or tenders, till after a satisfactory trial of the Coals and Cobbles or Nuts, to which such tender or tenders may relate, shall have been made. They are to be the best of their kind, *well screened*, and as free as possible from sulphur, bats, bind, refuse, and dirt, and shall be weighed (20 cwt. to the Ton) upon the Corporation machines, or upon such other machines as may be mutually agreed upon.
Payments will be made monthly, if and so long as the contract shall be duly fulfilled, to the extent of nine-tenths of the amount of the verified invoices, and the balance will be discharged on the satisfactory completion of the contract.
Further information, and forms on which the tenders must be made, may be obtained on application to Mr. J. Wilson, the General Manager, at the Gas Offices; and the tenders (sealed), specifying the description of Coals and the pits at which they are to be raised, and stating the prices for deliveries at the several places, and in manner and subject to the conditions aforesaid, must be delivered to Samuel George Johnson, Esq., Town Clerk, on or before Saturday, the 31st day of May next.
By order,
M. OGLE TARBOTTON, Borough Engineer.
Corporation Gas Offices, George Street,
Nottingham, May 9, 1879.

TO TAR DISTILLERS, MANUFACTURING CHEMISTS, AND OTHERS.

THE Directors of the Rochester, Chatham, and Strood Gaslight Company are prepared to receive TENDERS for the Purchase of the Surplus TAR from their Works at Rochester and at Gillingham.

Forms of tender and other particulars may be had on application at the Office, 56, High Street, Rochester, where tenders, marked "Tender for Tar," are to be sent not later than noon of Thursday, the 29th of May inst.

Tenders may be made for One or Two years, from the 1st of July next.

The Directors will not be bound to accept the highest or any tender.

W. STRES, Secretary.

May 1, 1879.

BRISTOL UNITED GASLIGHT COMPANY.

TENDER FOR COALS.

THE Directors of the Bristol United Gaslight Company invite TENDERS for the Supply of about 100,000 Tons of GAS COALS, during the Twelve months between the 1st of July, 1879, and the 1st of July, 1880, for use at their Works, situated respectively at Avon Street, St. Philip's, Canons Marsh, and Stapleton Road, Bristol.

Parties desiring to tender for these Coals can obtain specifications and full particulars as to delivery, &c., on application to the Secretary of the Company.

Sealed tenders to be addressed to the Chairman of Directors, Bristol United Gaslight Company, Canons Marsh, Bristol, marked "Tenders for Gas Coal," and delivered not later than Tuesday, the 3rd of June next.

HENRY H. TOWNSEND, Secretary.

Gaslight Offices, Bristol, May 9, 1879.

TO GASHOLDER MAKERS.

THE Sevenoaks Gas Company are prepared to receive TENDERS for the Erection, on their Works at Sevenoaks, of a Double-Lift GASHOLDER, 81 ft. in diameter and 40 ft. high.

Plans and specifications may be seen at the Company's Office, Sevenoaks, or at the Office of their Engineer, Mr. Alfred Penny, 20, Abingdon Street, Westminster, from whom may be obtained lithographed copies of the specification and conditions, price 5s.

Tenders to be sent in addressed to the Chairman of the Company, EDWYN CRONK, Esq., Sevenoaks, not later than the 28th inst.

At the same time the Directors will receive tenders for a 12-in. GOVERNOR of the best construction, with 12-in. Bye-pass Connections, fixed complete. Foundations will be prepared by Company.

May 12, 1879.

THE Mansfield Improvement Commissioners invite Tenders for the Supply of 4100 Tons of best Screened GAS COAL and CANNEL COAL required for use at their Gas-Works, to be supplied from June 1, 1879, to May 31, 1880, in the following proportions, viz.:—

200 tons in each of the months of June and July, 1879.

450 tons in each of the months of August, September, October, November, and December, 1879, and January, 1880.

350 tons in February, 1880.

250 tons in March, 1880, and 200 tons in each of the months of April and May, 1880, or in such other quantities as may be desired in similar proportions.

The Coal to be delivered at Mansfield Station or at the works, at the option of the sender, and to be free from sulphur, bats, bind, and refuse.

Tenders to be sent in on or before Tuesday, May 30, 1879, marked "Tender for Coal," and addressed to

R. J. PARSONS, Clerk to the Commissioners.

Mansfield, May 7, 1879.

TO CONTRACTORS AND OTHERS—TENDERS FOR GASHOLDER TANK.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the work required to be done in excavating for and constructing a Brick and Puddle GASHOLDER-TANK, 156 ft. in diameter, and 40 ft. 9 in. deep, with Dry Well, at their Effingham Street Gas-Works.

Drawings and specifications may be seen on application at the Chief Office, Commercial Street, and copies of the specification may be obtained on payment of £2 2s., which will be returned on receipt of a *bona fide* tender.

The party whose tender may be accepted will be required to enter into a contract for the due performance of the work.

The lowest or any tender will not necessarily be accepted.

Tenders to be sent in, addressed to the undersigned, on or before the 20th inst.

THOMAS ROBERTS, Manager.

Gas Office, Sheffield, May 2, 1879.

BOROUGH OF BARROW-IN-FURNESS.

SUPPLY OF GAS COAL AND CANNEL.

THE Corporation of the Borough of Barrow-in-Furness are prepared to receive TENDERS for the Supply of Screened GAS COAL and CANNEL, for One, Two, or Three years, from the 1st of July next. To be delivered by rail at the Gas-Works, Barrow-in-Furness.

The quantity required (Coal and Cannel) during the first Twelve months will be about 8500 Tons.

Further particulars and conditions of Contract may be obtained on application to Mr. W. Fergusson, Manager, Gas-Works.

Tenders addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Coal or Cannel," to be delivered at the Town Clerk's Office, Barrow-in-Furness, on or before Tuesday, the 20th inst.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
C. F. PRESTON, Town Clerk.

May 7, 1879.

TENDERS FOR GAS COAL.

THE Corporation of Walsall invite TENDERS for the Supply of 24,000 tons of Staveley, Yorkshire, or any other Good GAS COALS, to be delivered during One year from the 1st of July next, either at Walsall Railway Station, the Corporation siding at the new Gas-Works, or by boat at Walsall Old or New Gas-Works; in the latter case it will also have to be unloaded and stacked in the coal sheds, or at such other places at the Gas-Works as may be directed. The Coal will have to be delivered at the rate of from 100 to 850 tons per week, as the Corporation may from time to time require. Payments monthly.

The Corporation do not bind themselves to accept any tender, and they reserve the right to divide the contract between several firms.

Tenders, sealed and marked outside "Tender for Gas Coal," and stating the price for large Coal, and also for Nuts, are to be sent to the undersigned on or before Wednesday, the 28th inst.

SAMUEL WILKINSON, Town Clerk.

Bridge Street, Walsall, May 10, 1879.

BOROUGH OF BURNLEY.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Corporation of Burnley are prepared to receive TENDERS for a Supply of Good GAS COAL, screened or unscreened, for a period of One, Two, or more years, from the 1st of July next, to be delivered into waggons at their Wharf on the Leeds and Liverpool Canal.

The quantity required will be 15,000 tons for the first year, and the Contractor must agree to supply any additional quantity required at the contract price.

Persons tendering must state the name of the mine, and guarantee the particular seam from which the Coal is to be supplied, as free as possible from sulphur, bats, bind, dirt, refuse, &c.

Further particulars may be obtained on application to Mr. S. P. Leather, Gas-Works Manager and Engineer.

Sealed tenders, endorsed "Tender for Coal," stating the price per ton, screened and unscreened, must be sent to the Chairman of the Gas Committee, 1, York Street, Burnley, not later than the 28th of May inst.

By order,
A. B. CREEKE, Town Clerk.

Corporation Offices, Burnley, May 9, 1879.

THE ACCRINGTON GAS AND WATER-WORKS COMPANY.

COAL CONTRACTS.

THE Directors of this Company invite TENDERS for the GAS COAL and CANNEL they may require during One, Two, or Three years from the 1st of July next, to be delivered free in trucks at the Railway Station, Accrington, at the Canal Wharf, Oakenshaw, and, if required, on their Siding, Great Harwood; in such quantities, and at such times, as the Directors or Secretary for the time being may require.

Sealed tenders, endorsed "Tender for Coal," and addressed to the Chairman, General Offices, Gas-Works, Accrington, to be sent in not later than 6 p.m. of Wednesday, the 4th of June.

Printed conditions of tender may be obtained on application to the Secretary of the Company.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
CHARLES HARRISON, Secretary.

May 3, 1879.

SWANWICK CANNEL.

Illuminating power, 34 candles. Good Coke, 11¼ cwt. to the ton.

For analysis, prices, and references, apply to

H. BOAM, Litchurch Villa, DERBY.

SULPHATE OF AMMONIA APPARATUS.

I am now prepared to Erect Plant or Supply Plans of this New and Efficient System for Making Sulphate of Ammonia. For terms, &c., address as below. I have constructed a small apparatus (glass) which shows the principle and illustrates the working of the larger plant admirably. I guarantee this apparatus to give a first-class result in sulphate if worked according to my instructions, &c. Price of small apparatus, c.o.d., £1 1s.

Address JOHN G. HARVEY, 31, Old Georges Street, CORK.

WANTED, by Samuel Thompson & Co., Colliery Office, Lancaster, APPLICATION for PRICES from Gas Managers who are prepared to receive Tenders for GAS COAL or CANNEL.

John Leigh, Esq., M.R.C.S., F.C.S., &c., &c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash, and when Cannel of the best description is scarce, it may well replace this material."

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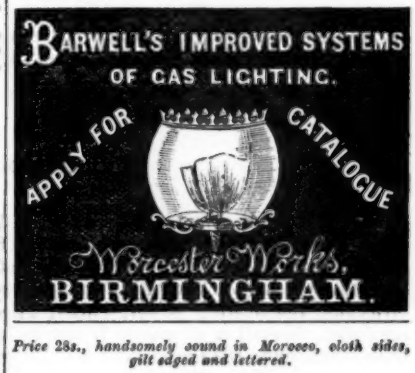
BERWICK-UPON-TWEED.

Makers of Socket, Flange, and Hot-Water Pipes, Tank-Plates, Lamp-Posts, Columns, Girders, and Gas and other Castings.

TO MAKERS OF SULPHATE OF AMMONIA AND BUYERS OR SELLERS OF GAS LIQUOR.

F. SUTTON & CO., Norwich, are now prepared to Supply a Set of Apparatus with Standard Test Solutions for the rapid and accurate analysis of Gas Liquor, which can be used by any intelligent workman, so as to show the actual amount of Sulphate which can be got out of any sample of liquor in a few minutes, without any of the annoyance arising from saturation with acid, &c. Tables are also given, showing the quantity of acid of various strengths required for any given liquor, the accurate ounce-strength and percentage of pure ammonia, &c. Price of the set, with full direction and table (copyright), with materials sufficient for fifty analyses, £4 4s.

Post orders or cheques to be made payable to F. SUTTON AND CO., Manufacturing Chemists, NORWICH, who also supply every description of Standard Solutions for Volumetric Analysis of Waters, Beers, Manures, &c., of guaranteed accuracy.



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The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

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Established 1840.

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(As supplied to Sir Wm. Geo. Armstrong, C.B.),
AND OF
Archer's Patent Ore Crusher & Pulveriser,
Unequalled for the purposes of Mine Owners, Chemical Manufacturers, Cement Manufacturers, and others.

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As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather, India-Rubber, and Gutta-Percha Machine-Bands, Sheet and Washers, and Steam Joints.

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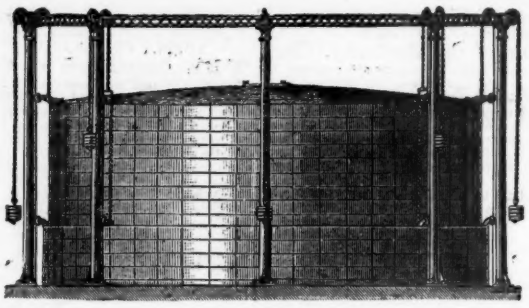

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PRECEDENTS IN PRIVATE BILL LEGISLATION
AFFECTING GAS AND WATER UNDERTAKINGS.

COMPILED BY MR. G. W. STEVENSON, C.E., F.G.S.

This Work contains information with regard to the practice of Parliament during the last fourteen years, in regard to most of the points on which differences arise in Opposed Bills for Gas and Water Undertakings, comprising—Authorized share and loan capital, Rates of dividend, Capitalization of profits, Term for the repayment of loans, Instances in which new shares are to be sold by auction and Exceptions to the Standing Order requiring new shares to be sold by auction, The limitation of back dividends, Illuminating power, Purity, Price, Notice before testing, The conditions under which the public supply of gas is regulated, Alteration of mains, Instances in which maps of mains are required, and All cases in which undertakings have been transferred, since 1845 in gas and 1865 in water, from Companies to Local Authorities.

In the Water Precedents will be found, in addition, The rates for a supply for domestic purposes, and the Rates for other than domestic purposes.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

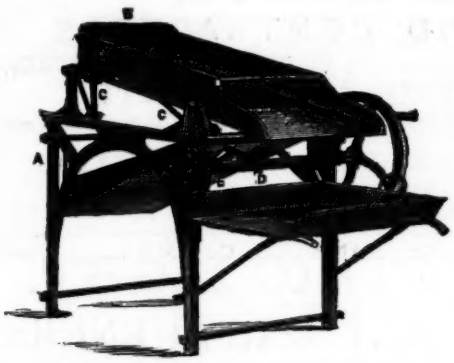
THE WIGAN COAL & IRON COMPANY,
LIMITED,
DISTRICT OFFICE: 97, NEW STREET, BIRMINGHAM; AGENT: W. M'GOWAN,
Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.
N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known
HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

LIVESEY FIRE-CLAY WORKS.
NEAR BLACKBURN, LANCASHIRE.
(ESTABLISHED 1835.)

ORLANDO BROTHERS, LIMITED,
MANUFACTURERS OF PATENT CLAY RETORTS,
AND EVERY DESCRIPTION OF
TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS, ETC.
FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.

PATENT
MACHINE-MADE RETORTS.

B. GIBBONS, JUN.,
STOURBRIDGE.



PRICE'S PATENT
LABOUR-SAVING SCREEN OR SIFTER.

In screening breeze, the coarse material falls on a tray supported by the handles of the Machine, thus making it convenient for picking the clinkers from the same, whilst the fine falls on a shoot behind, which is fixed to the bottom of the sieve B. In screening gravel or other material, the coarse will fall into a barrow direct, and the fine be conveyed by the shoot into a barrow at the other end, or at the bottom.

To practical men the advantages of this Machine will be evident. It secures at once a saving of time, labour, and expense, as by it a much greater quantity of material can be sifted in the same space of time.

Further particulars as to price, &c., may be obtained by applying to the Patentee (Hampton Wick), or to

ROBERT DEMPSTER & SONS,
(SOLE MANUFACTURERS),
ELLAND, NEAR HALIFAX.

HENRY LYON (14 years Engineer and Manager of the largest of the Manchester Corporation Gas-Works) Mechanical and Consulting Gas Engineer, reports upon the condition and value of Gas-Works, supplies plans and specifications of all Apparatus appertaining to Gas-Works, and re-models existing Works.

Address Brooklyn, near Halliwell Lane, Cheetham Hill Road, MANCHESTER.

W. LIDDALL,
Public Accountant,
MOORGATE STREET CHAMBERS,
GREAT SWAN ALLEY,
MOORGATE STREET, E.C.

Mr. ROBERT DEMPSTER,
CONSULTING GAS ENGINEER,
ELLAND, near HALIFAX,

May be consulted on all matters connected with Valuations, Arbitrations, and Parliamentary Applications connected with Gas-Works. Having been engaged on extensive Arbitration Cases, which, combined with his experience in Construction and Contracting, his knowledge of Engineering and Valuations is both extensive and reliable.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & CO., GHENT, will receive immediate attention.

THE FARNLEY IRON COMPANY, LIMITED,
FARNLEY, near LEEDS,
MANUFACTURERS OF
FIRE-CLAY GAS-RETORTS & FIRE-BRICKS,

Of every size and shape, and of the best quality; also of White and Coloured GLAZED BRICKS, SANITARY PIPES, &c., &c.

In order to meet the constantly increasing demand for their Gas-Retorts, the F. I. Co. have recently made such an addition to their premises as will enable them to execute expeditiously the largest home or foreign orders.

London Agent for Gas-Retorts: D. W. OGG, 3, Jeffrey's Square, St. Mary's Axe, E.C.
" " Glazed Bricks: A. BARFIELD, 22, Great George Street, Westminster.

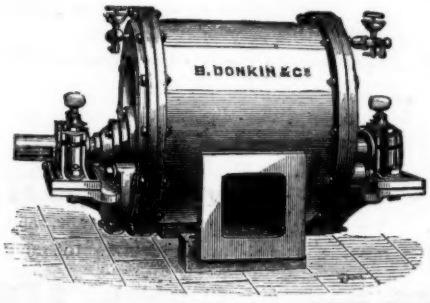
LIVESEY'S PATENT WASHER.

This apparatus effects the most intimate contact between the liquor with which it is supplied and the gas passing through it, resulting in the complete removal of all particles of tar, increasing the ammonia strength of the scrubber and condenser liquor, and removing a large proportion of other impurities—notably, carbonic acid. The Washer is intended to work in conjunction with a scrubber. It occupies little space, and is inexpensive. It has been in successful constant use for nearly three years, does not become clogged with tar or corroded by the action of the liquor or gases, it gives three inches of pressure, and only needs a supply of liquor to keep it in regular action without any further attention.

For Particulars and Prices apply to

Messrs. DEMPSTER AND SONS, ELLAND, HALIFAX, for the North;
Messrs. BAILEY, PEGG, AND CO., Bankside, LONDON, S.E., for the South;
Messrs. WILLEY AND CO., Commercial Road, EXETER, for West of England and South Wales
Or to the PATENTEE, 589, OLD KENT ROAD, LONDON, S.E.

J. BEALE'S NEW PATENT GAS EXHAUSTERS
MANUFACTURED SOLELY BY
B. DONKIN & Co.



These Exhausters have but one solid slide, which ensures less wear and friction, and thus fewer repairs are necessary. They are made with two outside bearings and with all latest improvements.

MESSRS. B. D. & CO. ALSO MAKE

STEAM-ENGINES FOR DRIVING GAS EXHAUSTERS.
IMPROVED GAS-VALVES.
VALVES FOR AMMONIACAL LIQUOR, TAR, and HYDRAULIC MAINS,
VALVES FOR SPECIAL PURPOSES, WITH COLUMNS,
SCALES, AND GAUGES.
STEAM, GAS THROTTLE, AND BYE-PASS VALVES.
SCREW WATER-VALVES, &c.

LISTS, PRICES, AND INFORMATION ON APPLICATION.

WORKS: 55a, BLUE ANCHOR ROAD, BERMONDSEY, LONDON, S.E.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, Gas-Works, Hampton Wick, MIDDLESEX.

Prices are Reduced.

JAMES NEWTON & SONS,
(Established 1820,)
FIRE-BRICK AND TILE MERCHANTS,
Wholesale and for Exportation,
FALCON DOCK, 78 AND 79, BANKSIDE,
SOUTHWARK, LONDON, S.E.,
DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for
GAS AND WATER WORKS.

WILLIAM HAILES,
Builder and Contractor
FOR THE ERECTION AND RESETTING OF RETORT-BENCHES.

Fire Goods and Iron Work Supplied.

Hailes's Improved Retort Settings guaranteed to produce the greatest amount of heat with a small per cent. of Fuel.

Plans and Specifications Prepared.

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TORBAY AND DART PAINT COMPANY, LIMITED.

WORKS:
DARTMOUTH & BRIXHAM (TORBAY) DEVON.
OFFICES:
23, GREAT GEORGE STREET, WESTMINSTER LONDON, S.W.

SOLE PROPRIETORS AND MANUFACTURERS OF
WOLSTON'S CELEBRATED
TORBAY IRON PAINTS.

TRADE MARK

These Paints have been for many years extensively used in Her Majesty's Royal Dockyards, Woolwich Arsenal, the Shorncliffe and Curragh Camps, War Departments, and Colonies, and are largely supplied to Railway, Harbour, and GAS COMPANIES, Shipowners, Engineering Establishments, Railway Carriage and Wagon Works, and the Paint Trade generally. They are the BEST PROTECTORS of WOOD, CEMENT, and IRONWORK, even arresting corrosion after it has set in; and their base being oxide of iron, they are free from those properties which make lead paints so destructive to iron. They do not scale or blister, are not affected by great heat, and are the only Paints which will resist the effects of sulphuretted hydrogen. Their DURABILITY and covering properties have borne the test of A QUARTER OF A CENTURY'S PRACTICAL TRIAL.

The undermentioned colours—ground in best linseed oil, and requiring only to be thinned down for use in the ordinary way—are kept in stock:—

Torbay Brown.	Torbay Red.
Dart Green.	Slate.
Dart Yellow.	Buff.
Brixham Black.	Torbay Chocolate.
Light Blue.	Cream Colour.
Dart Brown.	Dart Umber.
Imperial Stone.	Light Stone.
Bronze Green.	Salmon Colour.
Navy Green.	Lead Colour.
Carriage Red.	Dark Stone.
Light Lead.	Crystal Palace Blue.
Light Green.	Iron Grey.

All other Colours made to order.

READY-MIXED PAINTS.

A great variety of Colours ready mixed for the brush are also always kept in Stock, in 3 lb., 7 lb., 14 lb., and 28 lb. cans.

Prices and Testimonials on application.

JOHN HALL AND CO., STOURBRIDGE,
Manufacturers of FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.
N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

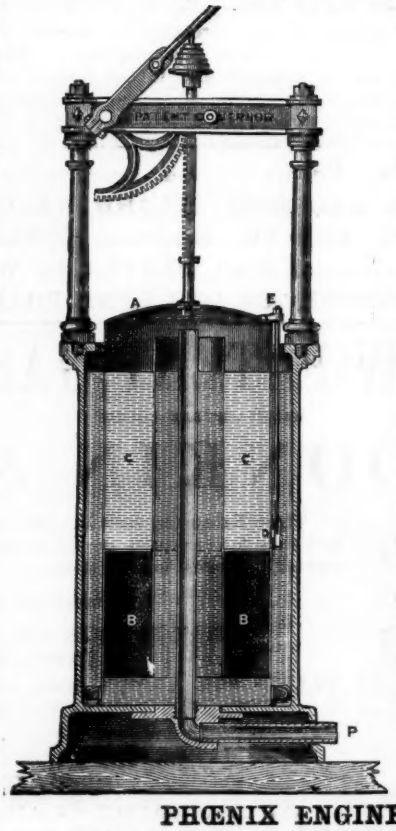
J. & H. ROBUS,
BUILDERS AND CONTRACTORS
FOR THE ERECTION AND REBUILDING OF GAS AND WATER WORKS,
RETORT-SETTING—A SPECIALITÉ,
ROBUS'S IMPROVED RETORT-SETTINGS, guaranteed to Carbonize a large amount of Coal with a small per cent. of Fuel.
ESTIMATES GIVEN FOR MAIN-LAYING.
N.B.—All kinds of Fire Goods and Gas Apparatus supplied on the shortest notice.
Address:—J. & H. ROBUS, BELL GREEN, CATFORD, LONDON, S.E.

GAS *v.* ELECTRIC LIGHT.
WIGHAM'S PATENT GAS-BURNERS
FOR
STREET LIGHTING, &c.

Speaking of these burners, erected on the Thames Embankment by Westminster Bridge, the *Daily News* says:
"... A blaze of light is thrown out, which, in point of efficiency and brilliancy, far surpasses the large gas-lamps lately erected in Waterloo Place, *while even the electric lights are quite thrown into the shade.*"

SOLE MANUFACTURERS:
J. EDMUNDSON & CO., GAS ENGINEERS,
19, GREAT GEORGE STREET, WESTMINSTER, LONDON, S.W.

GEORGE WALLER & CO.,
GAS AND HYDRAULIC ENGINEERS,
Patent Compensating Steam Governor,
WITH SELF-CONTAINED WATER-BALANCE.



DESCRIPTION OF THE APPARATUS.

The illustration represents a section of the Patent Governor. The lower part of the Bell A is fitted with a loose Float B, and in the upper part of the Bell is a deep annular Water Chamber C, at the bottom of which is an opening D, with a slide outside regulated by a Screw Spindle E, to allow the water to pass in and out of the Chamber C quickly or slowly, according to circumstances, but when once adjusted the slide does **not require altering.** This Self-compensating Chamber gives great steadiness to the up and down movement of the Bell and effectively prevents the "hunting" motion so common with other Governors, thereby ensuring a more perfect action on the throttle-valve of the Engine **than attained by any other.** The sketch shows the clip lever fixed to work on throttle-valve at an angle, and can work in either direction. P is the Gas Inlet-pipe to Governor.

G. W. & Co. also make **special Steam Throttle Valves,** suitable for working with this Governor, and alter existing Throttle Valves to same plan.

PHŒNIX ENGINEERING WORKS,
Holland Street and Bear Gardens, Southwark, S.E.

F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

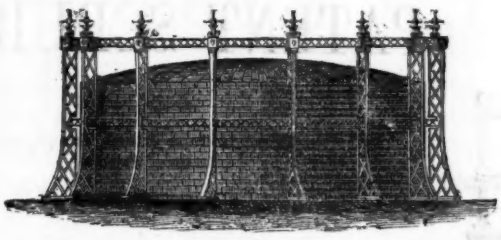
ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS.

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.



THE HORSELEY COMPANY,

LIMITED,

TIPTON, STAFFORDSHIRE.

LONDON OFFICE:

6, WESTMINSTER CHAMBERS, VICTORIA STREET,

GAS ENGINEERS, IRONFOUNDERS, &c.,

MANUFACTURERS OF

GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED LAMP-POSTS, PIPES,

AND ALL REQUISITES FOR EITHER

GAS OR WATER WORKS;

ALSO

MAKERS OF ROOFS, BRIDGES, &c.

S. OWENS & CO.,

WHITEFRIARS STREET, LONDON, E.C.,

HYDRAULIC ENGINEERS,

AND MANUFACTURERS OF

PUMPING MACHINERY of every Description.

SOLE LICENSEES AND MANUFACTURERS FOR GREAT BRITAIN OF

BLAKE'S PATENT STEAM-PUMPS.

More than 10,000 in use,

ESPECIALLY ADAPTED FOR USE IN GAS AND CHEMICAL WORKS, FOR PUMPING TAR, WATER, AMMONIACAL LIQUOR, ACIDS, &c.

The following are some of the prominent advantages of the BLAKE PUMP:—

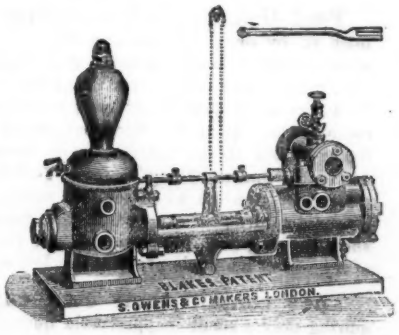
It will start at any point of stroke.

It has no dead point.

It works fast or slow, with the same certainty of action.

It is economical. Has a lead on the slide-valve.

It is compact and durable.



It is interchangeable in all its working parts.

It will deliver more water than any other pump.

It is made of best materials in the most workmanlike manner.

Can be worked at 20 strokes per hour, or 200 strokes per minute.

This Illustration represents Boiler-Feed Pumps, Sizes Nos. 1, 2, and 3, with Hand Lever for working Pump when Steam is not available.

SOLE MANUFACTURERS OF

MANN & OWENS

IMPROVED PATENT GAS-VALVES.

PRICED LISTS AND FULL PARTICULARS FURNISHED ON APPLICATION.

T. NEWBIGGING,

CONSULTING GAS ENGINEER,

5, NORFOLK STREET, MANCHESTER.

ALFRED LASS, F.I.Accts.,

SPECIAL ACCOUNTANT FOR GAS AND WATER UNDERTAKINGS,

30, GRACECHURCH STREET, LONDON.

Accounts Analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.

The Forms of Account, which have been specially designed by Mr. Lass to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, Corporations, and Local Boards.

THOMAS CARR & SON,

MANUFACTURERS OF

FIRE-BRICKS, LUMPS, TILES, RETORTS, &c.,

COTSWOOD FIRE-BRICK WORKS, SCOTSWOOD-ON-TYNE.

Also Makers of all kinds of Common Building Bricks, and of Pressed White and Red Bricks for Facing.

BIRTLEY IRON WORKS,

CHESTER-LE-STREET, DURHAM.

Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

Agent in London, Mr. J. MANWARING, 101 Cannon Street, E.C.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

WENLOCK IRON WHARF, 21 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,

Keep in London and at their works large stocks of PIPES and CONNEXIONS (1¼ to 36 inches in diameter); also make and supply Retorts, Tanks, Columns, Girders, Special Castings required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

CHARLES HORSLEY, Agent.

THE

SILICA FIRE-BRICK CO.,

OUGHTIBRIDGE

Near SHEFFIELD,

Manufacturers of THE ORIGINAL SILICA OR DINAS FIRE-BRICKS. Specially adapted for Gas-Retort Furnaces and for Siemens's Gas-Furnaces. Shipments promptly executed to London, Liverpool, Hull, Grimsby, &c.

TROTTER, HAINES, & CORBETT,

BRETTELL'S ESTATE

FIRE CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.

Proprietors of

BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.

Successors to

E. BAKER AND CO., LATE BRIERLEY HILL, STAFFORDSHIRE.

HARPER & MOORES,

PROPRIETORS OF THE

BEST STOURBRIDGE CLAYS,

STOURBRIDGE.

Manufacturers of all Descriptions of

BEST STOURBRIDGE FIRE-BRICKS, LUMPS AND CLAY RETORTS

Of all Dimensions for Gas-Works,

GLASS-HOUSE POTS & CRUCIBLES

ESTABLISHED 1836.

The Highest Award was obtained by H. & M., at the Philadelphia Exhibition, 1876, for Superior Quality of Manufacture. SILVER MEDAL, PARIS, 1878.

GAS AND WATER PIPES.

WILLIAM MACLEOD & CO.,

30, ST. ENOCH SQUARE, GLASGOW.

CAST-IRON GAS AND WATER PIPES.

DELIVERY F.O.B., GLASGOW

Prices on application.

C. & W. WALKER,
8, FINSBURY CIRCUS,
LONDON, E.C.

MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the im- portant results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

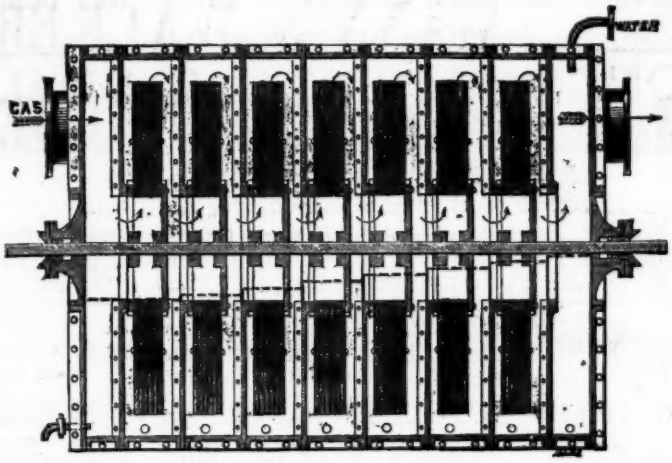
They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

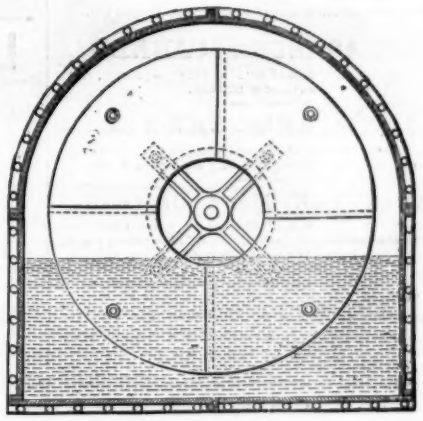
Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

THE

"STANDARD" WASHER & SCRUBBER.

[KIRKHAM, HULETT, AND CHANDLER'S PATENT.]





This Washer and Scrubber has been used for nearly two years on a large scale at the Works of The Gaslight and Coke Company, Bromley-by-Bow, at which station there are now several in operation and in course of construction. There is also one in use at the Pancras Station, King's Cross, of the same Company, which is purifying 1,500,000 cubic feet of gas per day. At the Gas-Works of the Corporation of Leeds, a large one has been erected, which is giving complete satisfaction. The Special Merits of this Washer are as follows:—

That it is a very effective Condenser, so that it is not absolutely necessary to reduce the temperature of the gas to 60°, or thereabouts, to make the Washer effective.

That the distribution of the liquor is made with unerring regularity.

That it occupies very small space, so that it can be, at little expense, effectually protected from extreme changes of the weather.

That the considerable expense of Coke or Wood, or other Scrubbing Material, is entirely saved, and that the great nuisance and cost of from time to time replacing the Scrubbing Material is avoided.

That, by the revolution of the discs, the quantity of water carried up by them, and tending continuously to fall, exposes a very large amount of fresh wetted surface to contact with the gas.

That it is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured.

That it is much cheaper than any other Scrubber that will do the same amount of work effectually.

That it is the only Washer suitable for purifying Gas from all its impurities by solution.

That it works with a minimum of pressure.

That it takes out every trace of Ammonia from the Gas in once traversing the machine.

That it requires very little outlay for foundations.

The following Testimonials show the opinion of eminent Engineers as to the capabilities of the Washer:—

(Copy.)

The Gaslight and Coke Company
Bromley-by-Bow, May 3, 1877.

D. HULETT, Esq.

Dear Sir,—In answer to your inquiries respecting the results of the working of your Patent Washer, I beg to state that I find it a very efficient machine. I have had it in operation for some time, and passed gas through it continuously at the rate of 100,000 cubic feet per hour, and obtained from it 11 gallons of 10 oz. liquor per ton of coal carbonized—results which appear to me very satisfactory for so small a Washer. It works very smoothly, taking but little power, and giving no pressure. I have it still in operation, and am perfectly satisfied with its working.

I am, dear Sir, yours truly, (Signed) W. B. WRIGHT.

(Copy.)

The Leeds Corporation Gas-Works,
York Street, Leeds, Dec. 6, 1878.

Messrs. KIRKHAM, HULETT, and CHANDLER.

Gentlemen,—The Scrubber-Washer erected by you at these works, and which has been in use for six months, has proved to be, so far as we have been able to test it, thoroughly efficient. We are at present making 32,000 feet of gas per hour, and are entirely dependent on this apparatus for the removal of Ammonia, and the **Gas is perfectly free from that impurity in the sixth chamber**, so that four chambers remain to deal with an increasing make of gas. Owing to insufficient condensers, the gas was in the summer admitted to the Scrubber at a temperature of 70°, but was reduced therein to 61°, or that of the atmosphere. The volutes are driven at the rate of four revolutions per minute, and, working at that speed, there is not the slightest difference between the inlet and the outlet pressure. Clean water supplied at the rate of 10 gallons per ton of coal carbonized is converted into liquor of from 10 oz. to 13 oz. strength **in once traversing the vessel.** The apparatus is extremely simple and compact, occupies but little space, and requires no foundation. I shall be surprised if it does not eventually become extremely popular.

I am, Gentlemen, yours faithfully, (Signed) HENRY WOODALL, Engineer.

(Copy.)

The Gaslight and Coke Company.
York Road, King's Cross, Jan. 14, 1879.

Messrs. KIRKHAM, HULETT, and CHANDLER.

Gentlemen,—In reply to your inquiry, I am pleased to say, the Washer which was put in action at this station in October last has quite fulfilled my expectations, as it confirms the experiments I made in May last with the smaller machine. Working at four revolutions per minute, **it takes out every particle of Ammonia**, while purifying more Gas than it was intended to do. I enclose particulars of a fortnight's working during our heaviest make, by which you will see that it yields the full quantity and strength of liquor, and works with little pressure. I am therefore quite satisfied with the machine, and trust it may meet with the success it deserves.

I remain, Gentlemen, yours truly, (Signed) JOHN CLARK.

The following Table shows the results of the working of one of these Washers, lately erected to purify 60,000 feet of Gas per Hour, at the St. Pancras Station of The Gaslight and Coke Company:—

1879.	Nos. of the Divisions and Strength of Liquor in each.										Water used per Ton of Coals.	Gas Purified per Hour, Cubic Feet.	Ammonia on Outlet.	Temperature.			Pressures.		Revolutions per Minute.
	1	2	3	4	5	6	7	8	9	10				Inlet.	Outlet.	Atmosphere.	Inlet, Inches.	Outlet, Inches.	
	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.									
January 1	8½	6¾	5	3½	2½	1½	¾	¼	0	0	10 Gallons.	52,000	Nil.	77°	73°	48°	24	23	7½
,, 2	8¾	7	6	4½	3¼	2½	1½	¾	¼	0	10 ,,	57,000	Nil.	73°	66°	32°	21¾	20½	4
,, 3	9¼	8	6	3¾	3	2½	1½	¾	¼	0	10 ,,	60,000	Nil.	75°	68°	40°	23½	22	4
,, 4	9¼	7¾	6¼	4¼	3¼	2¼	1¼	¾	¼	0	10 ,,	65,000	Nil.	74°	68°	33°	24	22½	5
,, 5	9¼	7	6	4	3	2½	1¼	1	¼	0	10 ,,	34,000	Nil.	77°	68°	35°	14½	14	5
,, 6	9¼	7¼	6½	4¼	3	2¼	1¼	1	¼	0	10 ,,	63,000	Nil.	72°	66°	27°	24	22½	4½
,, 7	11	9	7	5¼	3¾	3	1¾	1¼	½	0	10 ,,	59,000	Nil.	74°	66°	31°	25	23½	5
,, 8	9½	7½	6	4½	3	2	1	¾	¼	0	10 ,,	78,000	Nil.	73°	61°	31°	28	26½	4½
,, 9	11	9	7	5	3½	2½	1½	1	½	0	10 ,,	82,000	Nil.	74°	67°	33°	27½	25¾	5
,, 10	10½	8½	6¾	5	3½	2½	1½	1	½	0	10 ,,	66,000	Nil.	76°	64°	28°	28½	27	5
,, 11	12½	10	7¾	5¾	4¼	3½	1¾	1¼	½	0	10 ,,	61,000	Nil.	78°	64°	27°	26½	25¼	5
,, 12	11	8¾	6¾	—	—	—	1¼	¾	½	0	10 ,,	39,000	Nil.	74°	64°	27°	26¾	25¾	5
,, 13	13	10½	8¼	6	4¼	3½	2	1¼	½	0	10 ,,	78,000	Nil.	73°	65°	42°	28	26	5

(Signed) JOHN CLARK, Engineer.

WASHER-SCRUBBERS OF THIS PATENT ARE IN COURSE OF CONSTRUCTION FOR BECKTON, BRADFORD, GREENWICH, WOOLWICH, AND SEVERAL OTHER GAS-WORKS.

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Yields 12,360 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

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Yields 13,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash. This cannel is almost free from sulphur.

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Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full analyses on application at above address, or from Wedderspoon, Ferguson and Co., 21, Lime Street, London, E.C.

GAS COAL.

THE MIRFIELD COAL COMPANY are supplying GAS COAL of the best quality on trucks at their siding. This Coal contains 10 per cent. of Cannel, and, as analyzed by Mr. James Paterson, of Warrington, yields 12,600 *cubic feet of* 16·67 *candle gas, with* 1430 *lbs. of good Coke, per ton.* Ash in Coke, 1·88.

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Are prepared to Supply their excellent GAS COAL on very favourable terms.

This Coal yields more than 10,000 cubic feet per Ton of gas of good quality, *in practical working on the large scale.*

A large purchaser reports the coke to be clear, of a quality rarely equalled in the retort-furnace, and much liked by the stokers.

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This Coal is now highly approved of for gas making, and yields over 10,000 feet per ton of 15-candle gas, and about 14 cwt. coke.

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One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

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A negotiations respecting M. Brémond's patented process for preventing Deposits of

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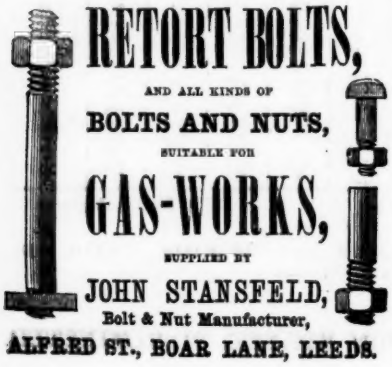
in Gas Main and Service Pipes should be addressed to Mr. W. H. Bennett, 22, Great George Street, Westminster, S.W., or to M. Bremond, Gas Engineer, Compania Madrilena de Alumbrado y Calefaccion por Gas, Madrid, who may be consulted upon all matters connected with the Gas Industry.



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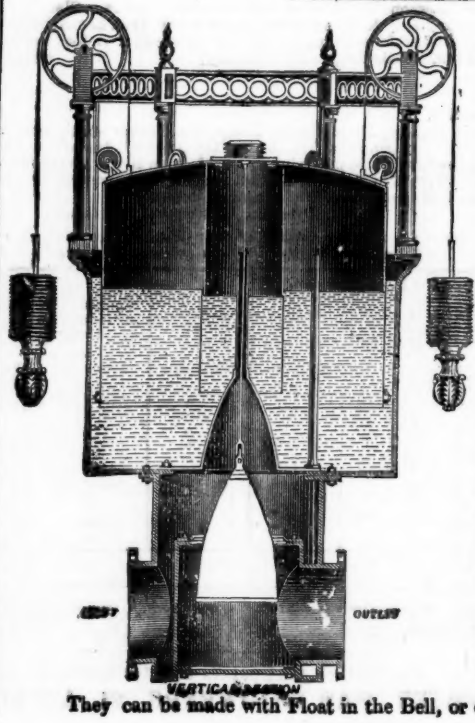
PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

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JAMES PATERSON Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces 12,240 cubic feet of 16·66 candle gas."

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THORNCLIFFE IRON-WORKS AND COLLIERIES,

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CELEBRATED SILKSTONE GAS COALS.

The various descriptions of Gas Coal produced from the above Collieries possess an unequalled reputation, combining in a large degree the constituents essential for the production of the best quality of Coke and Gas of a high illuminating power.

A recent extensive development of the Collieries enables us to offer increased supplies.

JAS. PATERSON, Esq., of Warrington, after testing various qualities of our Coal, has sent the following testimony of their merits:—

"*Warrington Gaslight and Coke Company,*
Offices, Mersey Street, Warrington, April 23, 1877.

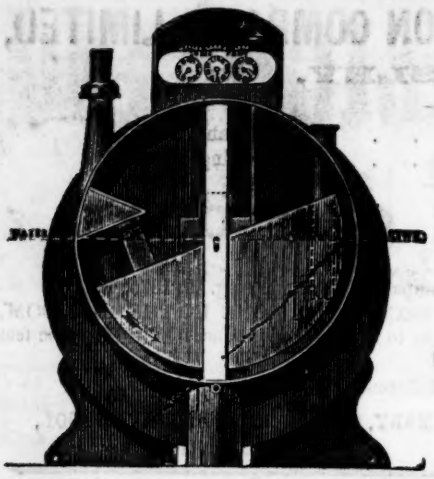
"MESSRS. NEWTON, CHAMBERS, AND CO.,

"GENTLEMEN,—After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

"The average of Nine samples gives a yield of 12,500 cubic feet of 15½-Candle Gas, being equivalent to 664 lbs. of sperm per ton, and 1420 lbs. of fixed carbon of a very superior quality. All the samples bear a close relation to each other in value.

"Yours truly, "JAMES PATERSON."

Full particulars will be sent on application to us—address as above.



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HYDRAULIC APPARATUS for Lifting and Lowering Purifier-Covers.

Sixteen recently erected at Beckton, applied to Covers 30 feet square.

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